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2d Session

HOUSE OF REPRESENTATIVES

REPORT
99-720

DEPARTMENT OF ENERGY CIVILIAN RESEARCH AND DEVELOPMENT AUTHORIZATION ACT FOR FISCAL YEAR 1987

JULY 28, 1986.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

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Mr. FUQUA, from the Committee on Science and Technology, submitted the following

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REPORT

together with

DISSENTING VIEWS

[To accompany H.R. 4925]

[Including cost estimate of the Congressional Budget Office]

The Committee on Science and Technology, to whom was referred the bill (H.R. 4925) to authorize appropriations to the Department of Energy for civilian research and development programs for the fiscal year 1987 and for the continuation in that fiscal year of prior year research and development projects, having considered the same, report favorably thereon with amendments and recommend that the bill as amended do pass.

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H.R. 4925 AMENDMENTS

The amendments as reflected in the introduced bill are as follows:

1. On page 2, line 4, strike "$283,321,000" and insert in lieu thereof "$300,077,000".

On page 2, line 5, strike "$141,590,000" and insert in lieu thereof "$147,429,000".

On page 2, line 7, strike "$115,177,000" and insert in lieu thereof "$123,135,000".

On page 2, line 8, strike "$23,180,000" and insert in lieu thereof "$24,737,000".

On page 12, line 20, strike "$17,000,000" and insert in lieu thereof "$20,000,000".

On page 12, line 24, strike "$66,303,000" and insert in lieu thereof "$34,423,000".

On page 12, line 25, strike "$474,711,000" and insert in lieu thereof "$506,591,000".

On page 13, line 2, strike "$131,729,000" and strike "$633,671,000" and insert in lieu thereof "$92,173,000" and "$676,227,000", respectively.

2. On page 3, line 12, strike "$27,000,000" and insert in lieu thereof "$33,000,000".

On page 3, line 14, strike "$84,800,000" and insert in lieu thereof "$88,800,000".

On page 3, line 18, strike "$16,700,000" and insert in lieu thereof "$19,700,000".

3. On page 3, line 23, strike "$9,500,000" and insert in lieu thereof "$16,100,000"; and strike "$3,000,000" and insert in lieu thereof "$9,600,000".

4. On page 4, line 14, strike "$25,219,000" and insert in lieu thereof "$30,919,000".

5. On page 11, line 12, strike the word "and"; and on line 15, after the semicolon, insert the word "and" and the following new subsection:

(M) Project numbered 87-R-770, General plant projects, Environmental compliance upgrade, Oak Ridge National Laboratory, Oak Ridge, Tennessee, $3,000,000;

6. On page 13, line 19, after the word "Standards," insert the phrase "the Bureau of Mines,".

On page 14, line 6, after the word "Standards," insert the phrase "the Bureau of Mines,".

7. On page 18, after line 5, insert the following new subsections:

(4) No amount appropriated pursuant to this Act may be used, directly or indirectly, in support of any operation which results in the willful release of radioactive water resulting from the accident at the Three Mile Island Nuclear Station Reactor Two into the Susquehanna River or its watershed; and

(5) No amount appropriated pursuant to this Act for Supporting Research and Technical Analysis may be used, directly or indirectly to fund the National Center for Chemical Research (84-ER-115), the Advanced Science Center (85-ER-133), the Center for Science and Technology, the Demonstration Center for Information Technologies, the Center for New Industrial Materials, the Energy Research Complex, the St. Christopher's Hospital for Children Energy Demonstration Project, the Center for Nuclear Imaging Research, and the Center for Excellence in Education—Energy Utilization Project, or any other such unauthorized project.

I. Background of the Bill

The Fiscal Year 1987 Department of Energy budget was submitted to the House of Representatives on February 5, 1986, by President Reagan.

On June 4, 1986, Chairman Don Fuqua introduced a bill, H.R. 4925, to authorize appropriations to the Department of Energy for civilian energy research and development programs and projects for Fiscal Year 1987. This bill was referred solely to the Committee on Science and Technology.

Extensive hearings were held during February and March, 1986, on the Department of Energy authorization requests. On June 4 and July 17, 1986, the Committee met to mark up the bill. After completing this action, the Committee reported the bill, H.R. 4925, as amended, on July 17, 1986, by a voice vote.

II. Hearings

A. Subcommittee on Energy Development and Applications

The Subcommittee on Energy Development and Applications held hearings on the fiscal year 1987 Department of Energy (DOE) authorization request for the Fossil Energy, Energy Conservation, Renewable Energy, Supporting Research and Technical analysis, Geothermal Resources Development Fund, and General Science

and Research programs on February 27, and March 4, 5, and 6, 1986.

DOE officials who testified included: Hon. Donna R. Fitzpatrick, Assistant Secretary for Conservation and Renewable Energy, accompanied by Mr. Alan J. Streb, Deputy Assistant Secretary for Conservation, and Dr. Robert San Martin, Deputy Assistant Secretary for Renewable Energy; Mr. Donald L. Bauer, Acting Assistant Secretary for Fossil Energy, accompanied by Mr. Jeremiah E. Walsh, Jr., Deputy Assistant Secretary for Management, Planning and Technical Coordination, Mr. Richard E. Harrington, Deputy Assistant Secretary for Coal Utilization, Advanced Conversion and Gasification, and Mr. Keith N. Frye, Deputy Assistant Secretary for Oil, Gas, Shale, and Coal Liquids; and Dr. Alvin W. Trivelpiece, Director of the Office of the Energy Research, accompanied by Dr. Donald K. Stevens, Associate Director of the Office of Basic Energy Sciences, Dr. William A. Wallenmeyer, Acting Associate Director of the Office of High Energy and Nuclear Physics, and Ms. Antionette Grayson Joseph, Director, Office of Field Operations Management.

In addition, the following citizens testified: Mr. David Gorin, Executive Vice President for the Solar Energy Industries Association; Mr. Scott Sklar, Director of Government Relations for the Solar Energy Industries Association; Dr. Walter J. Hesse, President of ENTECH, Inc., and Chairman of the Solar Thermal Power Division of the Solar Energy Industries Association; Mr. Roger G. Little, President of the Spire Corporation; Dr. Harold M. Hubbard, Director of the Solar Energy Research Institute; Dr. Donald L. Klass, Vice President of the Institute of Gas Technology and President of the Biomass Energy Research Association; Mr. Thomas O. Gray, Executive Director of the American Wind Energy Association, accompanied by Mr. Bob Sherwin, a Director of Enertech Corporatrion and President-Elect of the American Wind Energy Association; Dr. Carel Otte, President of the Unocal Geothermal Division, Unocal Corporation; Mr. William F. Uhl, Jr., Residential Construction Market Manager for the Glass Group of PPG Industries; Mr. David O. Webb, Senior Vice President for Policy and Regulatory Affairs, Gas Research Institute; Mr. George H. Lawrence, President of the American Gas Association; Dr. Bernard S. Lee, President of the Institute of Gas Technology; Dr. Gene G. Mannella, Director of the Washington Office of the Electric Power Research Institute; Dr. George F. Mechlin, Vice President—Research and Development, Westinghouse Electric Corporation; Mr. Michael S. Koleda, President of the Council on Synthetic Fuels; Dr. J. Read Holland, Director of the School of Mines and Energy Development at the University of Alabama; Dr. Charles J. Mankin, State Geologist, State of Oklahoma; Mr. Dave Brown, President of the MHD Industrial Forum; Dr. Francis G. Stehli, Dean of the College of Geosciences at the University of Oklahoma, and Member, Energy Research Advisory Board; Dr. Hermann A. Grunder, Director of the Continuous Electron Beam Accelerator Facility; Dr. John C. Browne, Associate Director for Research, Los Alamos National Laboratory; Dr. David A. Shirley, Director of Lawrence Berkeley Laboratory; Professor Richard B. Bernstein, Department of Chemistry and Biochemistry, University of California at Los Angeles; Dr. Nicholas P. Samios, Director of Brookhaven National Laboratory; Dr. Leon M. Lederman,

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Director of Fermi National Accelerator Laboratory; Dr. Burton Richter, Director of the Stanford Linear Accelerator Center; Dr. Alan Schriesheim, Director of Argonne National Laboratory; Dr. Herman Postma, Director of Oak Ridge National Laboratory; Dr. Robert S. Hansen, Director of Ames Laboratory; Dr. Mary L. Good, President—Director of Research, Signal Research Center, Inc., Dr. James H. Leonard, Vice President for Technology, Bethlehem Steel Corporation; Mr. Robert C. Howard, Executive Vice President, Thermo Electron Corporation; Mrs. Katie D. Tucker, Director, Florida Governor's Energy Office; Dr. Lloyd R. Lawrence, Jr., Vice President, Technology development, Mechanical Technology Incorporated, Mrs. Rosemary Pooler, Commissioner, New York State Public Service Commission; Dr. James W. Patten, Executive Engineer, Materials Engineering, Cummins Engineering Company, Inc.; and Mr. Morton Sherman, Project Manager, Commercial Development Group, Jim Walter Corporation.

B. SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS

The Subcommittee on Transportation, Aviation and Materials held hearings on the fiscal year 1987 Department of Energy (DOE) budget authorization request for the Transportation Energy Conservation program. The hearings were held on February 25 and 27, 1986.

DOE officials who testified were Hon. Donna R. Fitzpatrick, Assistant Secretary for Conservation and Renewable Energy; accompanied by Mr. Alan J. Streb, Deputy Assistant Secretary for Conservation.

In addition to DOE officials, the following individuals testified: Dr. Daniel Roos, Director, Center for Technology, Policy and Industrial Development, and Japan Steel Industry Professor, Massachusetts Institute of Technology; Mr. Noel P. Nightingale, Director of Programs, Stirling Engine Systems Division, Mechanical Technology, Inc.; Mr. John A. Boppart, Senior Vice President, Garrent Turbine Engine Company, The Garrett Corporation; Mr. Harold E. Helms, Chief Engineer, Vehicular Turbines, Power Products Group, General Motors Corporation; Dr. Vincent M. Halsall, Vice President, Battery Division, Johnson Controls, Inc. and Dr. Victor J. Tennery, Director, High Temperature Materials Laboratory, Oak Ridge National Laboratory.

C. SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT

The Subcommittee on Natural Resources, Agriculture Research and Environment held a hearing on the Department of Energy's fiscal year 1987 budget request for environmental programs on March 6, 1986.

Testimony was received from: Dr. James Kane, Special Assistant for Office of Laboratory Affairs, University of California; Ms. Mary Walker, Assistant Secretary for Environment, Safety and Health, U.S. Department of Energy; and Dr. Alvin W. Trivelpiece, Director, Office of Energy Research, U.S. Department of Energy.

D. SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION

The Subcommittee on Energy Research and Production held hearings on the Fiscal Year 1987 Department of Energy budget request for the Nuclear Fission R&D program, including an overview of the program and discussions on the Civilian Reactor Development and Advanced Nuclear Systems programs; Uranium Enrichment Activities; Electric Energy Systems, Energy Storage Systems, and Small-Scale Hydroelectric Systems; and Magnetic Fusion Energy. The hearings were held on February 25, 26, and 27, March 6, 11, and 12, 1986. Testimony was received for the record on Nuclear Waste Management, Nuclear Waste Fund, and Remedial Action.

DOE officials who testified included: Dr. Alvin W. Trivelpiece, Director of Energy Research; Dr. John F. Clarke, Associate Director for Fusion Energy, Office of Energy Research; Mr. James Vaughan, Acting Assistant Secretary for Nuclear Energy; Mr. Delbert F. Bunch, Acting Deputy Assistant Secretary for Reactor Systems, Development; Mr. Griffith; Mr. Lyle C. Wilcox, Deputy Assistant Secretary for Reactor Systems, Development and Technology; Mr. Gary L. Bennett, Deputy Director, Division of Special Applications; Mr. John R. Longenecker, Deputy Assistant Secretary for Uranium Enrichment; Mr. Wilbur Walker, Assistant Manager for Enriching Operations, Oak Ridge Operations Office; Hon. Donna Fitzpatrick, Assis ant Secretary for Conservation and Renewable Energy.

In addition to DOE off cials, testimony was received from: Hon. Fortney H. (Pete) Stark, (D–CA), Member of Congress; Hon. Mike McCormack, former U.S. Representative; Dr. Allen T. Mense, Vice Chairman, Energy Committee, Institute of Electrical and Electronic Engineers; Prof. George Miley, President, University Fusion Association, University of Illinois; Mr. Fred Mynatt, Associate Director, Nuclear and Engineering Technologies, Oak Ridge National Laboratory; Mr. Tom Claudson, Battelle-Pacific Northwest Laboratories; Mr. Charles Till, Associate Laboratory Director for Reactor R&D, Argonne National Laboratory; Mr. John Nolan, President, Hanford Engineering Development Laboratory, Westinghouse Hanford; Mr. Michael Stevenson, Division Leader, Energy Division, Los Alamos National Laboratory; Dr. Raymond S. Colladay, Associate Administrator, Office of Aeronautics and Space Technology; Col. George Hess, Director of Survivability, Lethality and Key Technologies, Strategic Defense Initiative Organization; Col. James Heilman, Deputy Director, Space Directorate, United States Air Force; Col. Roger A. McClain, Chief, Defense & Surveillance Division of the Air Force's Deputy Chief of Staff for Research, Development, and Acquisitions; Mr. Jack Berga, Washington Representative of Nuclear Division, Electric Power Research Institute; Mr. Carl Walske, President, Atomic Industrial Forum, Inc.; Mr. Mitchell Diamond, Vice President, Atomic Industrial Forum, Inc.; Mr. Richard A. Walker, Chairman, Gas-Cooled Reactor Associates; Mr. Richard A. Dean, Senior Vice President, GA Technologies, Inc.; Mr. Warren P. Chernock, Vice President, R&D Nuclear Power Systems, Combustion Engineering, Inc.; Dr. Bertram Wolfe, Vice President and General Manager, Nuclear Technologies and Fuel Division, Gener-

al Electric Company; Mr. John McDonald, Director, Atomics International, Rocketdyne Division, Rockwell International Corporation; Mr. W. H. Arnold, General Manager, Advanced Energy Systems Division, Westinghouse Electric Corporation; Mr. John L. Emmett, Associate Director for Lasers, Lawrence Livermore National Laboratory; Mr. Jack Fager, Senior Vice President for Engineering and Operations, Middle South Utilities, Inc., Representing Edison Electric Institute and the American Nuclear Energy Council; Mr. George F. Mechlin, Vice President, Research and Development, Westinghouse Electric Corporation; Mr. Roger S. Carlsmith, Director, Conservation and Renewable Energy Program, Oak Ridge National Laboratory; Mr. Charles Claar, Representing the Institute of Electrical and Electronics Engineers, Inc.; Mr. Donald R. Glenn, Vice President, Energy Research Council; Mr. Andrew F. Corry, Chairman, Committee on Electric Energy Systems, National Research Council; Philip R. Clark, President, General Public Utilities, Charles W. Pryor, Vice President and General Manager, Nuclear Power Division, Babcock & Wilcox, Dr. Armand J. Silva and Dr. Kenneth Hinga, University of Rhode Island, and statements from the Electric Power Research Institute, Pacific Northwest Laboratory, and the National Electrical Manufacturers Association.

III. Summary of Committee Actions

COMMITTEE AMENDMENTS

Explanation of Amendments—H.R. 4925

(1) The first amendment increases the funding for several programs to bring the levels to those of the FY 1986 appropriations. The programs affected by this amendment are Fossil Energy (+$19,584,000), Energy Conservation (+$5,839,000), Solar Energy (+$7,958,000), Geothermal Energy (+$1,557,000), Supporting Research and Technical Analysis (+$31,880,000), and General Science and Research (+$42,556,000). Two additional actions reduce the funding for Fossil Energy in order to provide for a deferral of funds (−$2,607,000) and to remove the funding for the federal inspector which is authorized in H.R. 4926 (−$221,000). Thus, the net change to the amount for Fossil Energy operating expenses resulting from this amendment is an increase of $16,756,000.

(2) The second amendment increases the funding for three Nuclear Fission R&D programs to provide for research associated with passive safety designs and the related testing of new fuels and graphite.

(3) The third amendment increases the funding for research on subseabed disposal of nuclear waste.

(4) The fourth amendment increases in funding for two activities in the Electric Energy Systems and Energy Storage programs.

(5) The fifth amendment is a technical amendment to insert a project which was omitted when the bill was introduced.

(6) The sixth amendment provides for the inclusion of the Bureau of Mines in the steel R&D program outlined in the bill.

(7) The seventh amendment adds two new subsections to the general provisions of the bill; one provision would prohibit the use of funds for activities associated with the release of radioactive water

from the damaged Three Mile Island nuclear unit into the Susquehanna River, and one provision would prohibit the use of funds for certain unauthorized projects in the Basic Energy Sciences program.

FISCAL YEAR 1987 CIVILIAN ENERGY R&D PROGRAMS

[In thousands of dollars]

	Fiscal year—		Committee action	
	1986 budget authority (estimate)	1987 DOE request	Changes to DOE request	Total authorization
Fossil energy:				
Operating expenses	336,276	149,869	+150,208	300,077
Capital equipment	2,865	0	+4,450	4,450
Construction	3,332	0	+4,000	4,000
Total, fossil energy	342,473	149,869	158,658	+308,527
Energy conservation:				
Operating expenses	142,748	64,823	+82,606	147,429
Capital equipment	2,793	100	+3,000	3,100
Construction	12,412	0	0	0
Total, energy conservation	157,953	64,923	+85,606	150,529
Energy supply R&D:				
Renewable energy:				
Solar energy:				
Operating expenses	135,115	67,477	+55,658	123,135
Capital equipment	3,571	2,085	+1,000	3,085
Construction	1,993	230	0	230
Total, solar energy	140,679	69,792	+56,658	126,450
Geothermal energy:				
Operating expenses	26,200	17,930	+6,807	24,737
Capital equipment	481	0	0	0
Total, geothermal	26,681	17,930	+6,807	24,737
Electric energy systems/energy storage systems:				
Operating expenses	28,648	16,219	+14,700	30,919
Capital equipment	192	0	0	0
Total, EES/ESS	28,840	16,219	+14,700	30,919
Subtotal, renewable energy	196,200	103,914	+78,165	182,106
Nuclear fission (supply R&D):				
Operating expenses	380,694	314,020	+56,900	370,920
Capital equipment	16,587	14,580	+800	15,380
Construction	5,484	8,800	0	8,800
Total, nuclear fission supply R&D	402,765	337,400	+57,700	395,100
Magnetic fusion energy:				
Operating expenses	324,537	307,490	+5,000	312,490
Capital equipment	28,279	17,310	.....	17,310
Construction	12,653	8,200	.....	8,200
Total, magnetic fusion	365,469	333,000	+5,000	338,000
Inertial confinement fusion operating expenses	NA	NA	+3,000	3,000
Supporting research and technical analysis:				
Operating expenses	371,270	417,285	+16,479	433,764
Capital equipment	27,200	32,775	.....	32,775

FISCAL YEAR 1987 CIVILIAN ENERGY R&D PROGRAMS—Continued

[In thousands of dollars]

	Fiscal year—		Committee action	
	1986 budget authority (estimate)	1987 DOE request	Changes to DOE request	Total authorization
Construction	97,030	74,475		74,475
Subtotal	495,500	524,535	+16,479	541,014
General reduction			−34,423	−34,423
Total, supporting research	495,500	524,535	−17,944	506,591
Environmental R&D:				
Operating expenses	216,576	259,763		259,763
Capital equipment	8,900	10,600		10,600
Construction	3,127	3,500		3,500
Total, environmental	228,603	273,863	0	273,863
Total, energy supply R&D	1,688,537	1,572,739	+125,921	1,698,660
Geothermal resources development fund: Operating expenses total	69	72	0	72
General science and research:				
Operating expenses	516,284	604,900		604,900
Capital equipment	83,387	93,500		93,500
Construction	61,751	75,000	−5,000	70,000
Subtotal	661,422	773,400	−5,000	768,400
General reduction			−92,173	−92,173
Total, general science and research	661,422	773,400	−97,173	676,227
Nuclear fission (uranium enrichment R&D):				
Operating expenses	126,975	54,000	+51,000	105,000
Capital equipment	14,429	0		0
Construction	2,886	0		0
Total, uranium enrichment	144,290	54,000	+51,000	105,000
Total, fiscal year 1987 energy R&D programs:				
Operating expenses	2,605,392	2,273,848	+442,358	2,716,206
Capital equipment	188,684	170,950	+9,250	180,200
Construction	200,668	170,205	−1,000	169,205
Total	2,994,744	2,615,003	+405,608	3,065,611
General reductions			−126,596	−126,596
Total, gross authorization	2,994,744	2,615,003	+324,012	2,939,015

IV. Civilian Research and Development Programs—Fiscal Year 1987

A. FOSSIL ENERGY

The Department of Energy's fossil energy activities are divided into three categories: (1) coal, (2) petroleum, and (3) gas. The Department's budget proposal for fiscal year 1987 requests $82,227,000 for coal research activities, $9,890,000 for petroleum research activities, $5,252,000 for gas research activities, $40,000,000 for program direction and management support, and $12,500,000 for Cooperative Venture R&D Pools. This $149,869,000 request for Fossil

Energy R&D represents a 56-percent reduction from the fiscal year 1986 appropriation of $342,473,000.

COMMITTEE VIEWS

Enhanced oil recovery, oil shale, advanced process technology and unconventional gas recovery

The Committee recognizes the large number of common technical and scientific similarities among the extraction and upgrading technologies for the liquid and gaseous fuels from enhanced oil recovery, tar sands, oil shale and unconventional gas. To exploit all possible synergies in research, technology, and management, the Committee encourages the Department to consolidate the management of these programs. Because the ultimate success of the technologies that will result from these programs requires close interaction with the scientists and technologists in the private sector who will apply them and with the governments of the States in which they will be applied, and because the majority of these resources lie in the mid-continent and Western States, the Committee encourages the Department to place responsibility for this consolidated management at the Bartlesville Project Office. The Committee encourages the Department to continue the work of these programs at the National Institute for Petroleum and Energy Research (NIPER), the Western Research Institute (WRI), universities, National Laboratories, and other appropriate contract research organizations. The Committee also encourages the Department to continue the Bartlesville Project Office's analytical and informational cooperation with the petroleum engineering community and, especially, with the producing states. The Committee further encourages the Department to develop and submit for Committee review and approval a comprehensive plan for conversion of the Federal research facilities at Bartlesville (other than offices for the Bartlesville Project Office) to government-owned, contractor-operated status at the conclusion of the Department's Cooperative Agreement with the National Institute for Petroleum and Energy Research. Because that Agreement is scheduled to terminate at the end of fiscal year 1988, the Committee encourages the Department to submit this plan no later than October 1, 1986. The Committee encourages the Department to permit the operator to accept outside work providing the work does not interfere with the Department's priorities.

Enhanced oil recovery techniques

In recommending an increase in the authorization of funds for research and development on enhanced oil recovery techniques, the Committee believes it is critical to continue an intensive program of research into unlocking the secrets which now prevent producers from recovering the vast volumes of energy which remain out of reach of conventional recovery methods. Notwithstanding current market conditions, the Committee notes that the United States remains perilously dependent on foreign sources and counts on overseas suppliers for approximately one-half of its daily petroleum needs while known domestic reserves are being depleted at a rate far in excess of the rate of new discoveries.

Current technologies promise an average recovery rate of thirty percent of a field's resources; thus, many reserves are abandoned though they still may hold as much as seventy percent of their original volume of oil and gas. Each time a field is abandoned as "dry" because of the limits of current technology, U.S. dependence on foreign oil increases and the domestic energy industry, and the industries and regions which depend on it, suffer. This problem is particularly acute in areas dominated by wells with relatively low levels of production. So-called stripper wells account for an increasingly significant amount of the domestic industry, currently contributing some twenty-two percent of daily U.S. production. Industry estimates that as much as 300 billion barrels of oil has been discovered in the U.S. that can be produced only by the techniques supported by this authorization.

Today's research and development holds the key to the economic vitality of tomorrow's domestic energy industry and the key to tomorrow's energy security. The Committee recognizes the crucial role a positive federal commitment to enhanced oil recovery research means to that future; the current depression in the energy industry has left it with few, if any, resources to conduct the massive research projects needed to bring these new technologies into practice. The Committee commends the work being undertaken under the auspices of the National Institute for Petroleum Research on enhanced recovery and with this recommended funding level, believes not only that this vitally important research should continue unimpeded, but that it should be aggressively pursued.

COMMITTEE ACTIONS

Coal

Control technology and coal preparation

The Committee's recommendations for Control Technology and Coal Preparation add $12,053,000 to the Department's request for a total authorization of $30,200,000 to provide: (1) $12,200,000 for Coal Preparation; (2) $13,300,000 for Flue Gas Cleanup; (3) $3,839,000 for Gas Stream Cleanup; and (4) $861,000 for Waste Management.

Within the total provided for Coal Preparation, $750,000 is for testing various concepts, such as chemical and electrochemical cleaning processes to reduce the sulfur content of coal; $1,500,000 to continue high-sulfur coal research actitivies at the Southern Illinois University Coal Technology Laboratory for a period of twelve months, subsequent to the activities funded through February 28, 1987; $1,050,000 for ancillary operations related to the cleaning of coal (communication, fine coal dewatering, transportation and storage); and $2,000,000 for testing of additional advanced physical coal cleaning technologies at the Electric Power Research Institute Clean Coal Test Facility.

Within the total provided for Flue Gas Cleanup $1,500,000 is for advanced NO_x control technology development; $1,500,000 for advanced separation technology; $2,000,000 to continue testing and evaluation of acid rain precursor control technology processes; and $800,000 for testing of sorbents for boiler injection applications.

Advanced research and technology development

The Committee's recommendations for Advanced Research and Technology Development add $5,976,000 to the Department's request for a total authorization of $33,200,000 to provide: (1) $11,400,000 for Direct Utilization, including $2,000,000 for the internally recirculating material gasification of coal; (2) $9,160,000 for Materials and Components; (3) $6,518,000 for Technology Crosscut; and (4) $6,122,000 for University Coal Research.

Coal liquefaction

The Committee's recommendations for Coal Liquefaction add $17,353,000 to the Department's request for a total authorization of $26,500,000, including $2,000,000 for the scale-up of the most promising benchscale concepts in the coprocessing of coal and petroleum, and $2,000,000 for termal liquefaction (pyrolysis). This increase will also provide: (1) $5,620,000 for Advanced Research; (2) $6,550,000 for Indirect Liquefaction, including $4,100,000 to continue the La Porte, Texas, liquid methanol facility; (3) $13,300,000 for Direct Liquefaction, including $5,300,000 to continue the Wilsonville Alabama, liquefaction facility with private sector participation equal to or greater than $2,700,000 and (4) $1,030,000 for Support Studies/Engineering Evaluations.

Combustion systems

The Committee's recommendations for Combustion Systems add $8,031,000 to the Department's request for a total authorization of $17,200,000 to provide: (1) $2,590,000 for Atmospheric Fluidized Bed Combustion, (2) $6,690,000 for Pressurized Fluidized Bed Combustion; (3) $3,880,000 for Advanced Combustion Technology, including $2,000,000 for the continued development of combustion technology and devices for heavy industrial and utility applications; and (4) $4,040,000 for Alternative Fuels, including the completion of detailed combustion characterization and assessments on industrial, commercial, and residential boiler/furnace systems, with emphasis on coal-liquid mixtures produced with highly beneficiated (including microbiologically- or chemically-cleaned) ultra-fine coals.

Fuel cells

The Committee's recommendations for Fuel Cells and $22,177,000 for a total authorization of $27,177,000 to provide: (1) $14,877,000 for Phosphoric Acid Systems including support of the 7.5-megawatt research program to complete testing on 25-kilowatt and 100-kilowatt stacks and to initiate construction of a full scale 375-kilowatt module, completion of the existing activity related to the development of a 25-kilowatt, organic liquid-cooled fuel cell. Also included in the Committee's recommendation is $1.477 million for the 40 KW testing under the cost-shared DOE/GRI program. The DOE should also complete the 11 MW configuration "B" stack development through full area short stack demonstration tests and the phosphoric acid water-cooled onsight fuel cell program in order to extend operation of the 40 kw verification test article; (2) $7,700,000 for Molten Carbonate Systems, which includes the award of contracts for internal and external free-forming fuel cells, the continu-

ation of existing contractors until the competitive contracts are awarded, and continued development of a contaminant resistent fuel cell concept; and (3) $4,600,000 for Advanced Concepts to continue the development of a solid oxide fuel cell module including research on cell fabrication techniques.

Heat engines and heat recovery

The Committee's recommendations for Heat Engines and Heat Recovery add $7,958,000 to the Department's request for a total authorization of $15,900,000. Within this total, $11,300,000 is provided to pursue the development of major systems components consistent with the multiple awards made in fiscal year 1986 and necessary supporting research work for a coal-fired gas turbine system. This effort will be directed toward an integrated system validation in the 1990–1992 time period. Also within the total, $3,200,000 is provided to modify existing contracts and pursue the development of coal-fueled diesel engines aiming toward integrated system validation testing in the 1992–1994 time period.

Underground coal gasification

The Committee's recommendations for Underground Coal Gasification add $2,000,000 to provide for a total authorization of $2,000,000. Funds are provided to complete the joint Gas Research Institute/Department of Energy Controlled Retraction Injection Point test of a parallel-row burn utilizing subbituminous coal and to provide technology base and evironmental support for the underground coal gasification process.

Magnetohydrodynamics

The Committee's recommendations for Magnetohydrodynamics add $23,500,000 to the Department's request for a total authorization of $23,500,000. Funding is provided for the Federal participation in the June 1984 multiyear, cost-shared magnetohydrodynamics program targeted on proof-of-concept testing, and at the cost-sharing rate established in the fiscal year 1986 appropriation legislation. Private sector participants are encouraged to define the extent to which they could augment the program, both technically and financially, by obtaining ownership and operating the Component Development and Integration Facility and the Coal Fired Flow Facility plants for the program and for analogous domestic and foreign processes.

Surface coal gasification

The Committee's recommendations for Surface Coal Gasification add $20,502,000 to the Department's request for a total authorization of $26,100,000 including $3,000,000 to test pollutant recycle and hot particulate removal at 500 pounds per square inch pressure in an existing process development unit. These increases will provide: (1) $4,220,000 for Advanced Research, including $1,000,000 for the biocleaning and determination of burn profiles for fine coal, and $2,000,000 to utilize experimental data on ash chemistry and fluidization behavior to modify and verify existing ash agglomerating gasifier fluid bed gasification models; (2) $5,150,000 for Advanced Process Development including $2,000,000 for mild gasifica-

tion techniques producing a variety of fuel forms, such as condensables, and sufficient quantities of liquid for actual engine testing in internal combustion engines and turbines; (3) $15,430,000 for System Engineering Concepts including $9,000,000 to continue program activities at the Waltz Mill gasifier; (4) $1,300,000 for Environmental and Engineering Analysis; and (5) no funding for the Great Plains Coal Gasification Project. Also, within the total of $15,430,000 provided for Systems Engineering Analysis, additional activities will include the operation of the Morgantown Energy Technology Center fixed-bed gasifier to study coal-fines injection and hot sorbent testing for sulfur removal, operation of the Schenectady fixed-bed gasifier to study the integrated operation, and control of a hot gas de-sulfurization system in a combined cycle power generation simulation.

Petroleum

Advanced process technology

The Committee's recommendations for Advanced Process Technology add $4,189,000 to the Department's request for a total authorization of $6,000,000 to provide: (1) $5,500,000 for Advanced Exploratory Research; and (2) $500,000 for Arctic and Offshore Research.

Enhanced oil recovery

The Committee's recommendations for Enhanced Oil Recovery add $17,516,000 to the Department's request for a total authorization of $22,000,000 to provide for (1) $4,000,000 for Heavy Oil, including studies in fluid-flow steam additive mobility control and sweep efficiency, joint research with Venezuela and Mexico, studies relating to in-situ recovery process, and studies in microbial-enhanced oil recovery; (2) $16,000,000 for Light Oil, including investigations of high-temperature stable polymer systems, studies of geologic and rock fluid behavior, continuation in basic and novel extraction concepts, continuation of studies utilizing CO_2 and other gaseous flooding concepts with emphasis on mobility control, and continuation of studies in microbial-enhanced oil recovery; and (3) $2,000,000 for Tar Sands, including continuation of tar sands research on basic parametric studies of thermal in-situ recovery processes, the cooperative program with Canada, and studies relating to fundamental process chemistry and environmental studies.

Oil shale

The Committee's recommendations for Oil Shale add $8,405,000 for a total authorization of $12,000,000 to provide $10,000,000 for Oil Shale Technology Base, including $1,000,000 for continuation of advanced generic research on oil shale extraction and processing at the Idaho National Engineering Laboratory, and $2,000,000 for Environmental Mitigation. Within the $10,000,000 Oil Shale Technology Base program, $6,000,000 shall be directed toward Eastern Oil Shale research, including $1,500,000 for continuing pressurized hydroretorting research; $1,500,000 for continuing oil shale beneficiation research. There is also $2,000,000 for novel concepts research.

Gas

Unconventional gas recovery

The Committee's recommendations for Unconventional Gas Recovery add $4,748,000 to the Department's request for a total authorization of $10,000,000 to provide: (1) $1,000,000 for Eastern Gas Shales including the provision for the stimulation of a directionally-drilled borehole and the continuation of special geosciences investigations in Eastern shales; (2) $7,000,000 for Western Tight Gas Sands to continue the Multi-well Experiment program, to continue geological engineering studies of the Unita and Greater Green River Basins, to conduct well tests in other parts of the Piceance Basin, and for generic evaluations; and (3) $2,000,000 for Environmental and Advanced Research including the continuation of research on the subduction theory which addresses detection and differentiation means and cooperation with the National Science Foundation in the selective coring of active subduction zones, continuation of a broad-based program in methane hydrates that addresses resource identification, geosciences relating to hydrates, and cooperation with industry in acquisition of well data and model evaluation.

Policy and Management

The Committee's recommendations for Policy and Management add $16,750,000 to the Department's request for a total authorization of $56,750,000 to provide: (1) $48,300,000 for operating expenses; (2) $4,450,000 for capital equipment; and (3) $4,000,000 for construction.

Cooperative Venture R&D Pools

The Committee recommends no funding for Cooperative Venture R&D Pools due to lack of definition in the Department's request. The Committee supports the Cooperative R&D venture concept realizing the need to limit the Federal role consistent with budgetary constraints. This concept would also provide an effective tool for technology transfer. Due to its lack of definition in the current budget book submission, the Committee directs the Department of Energy to provide full definition of the concept prior to its fiscal year 1988 budget submittal and request for authorization.

DETAILED SUMMARY

Details of the Committee's recommendations, current year estimates and the budget request for Fossil Energy are shown on the folllowing tables:

FOSSIL ENERGY—FISCAL YEAR 1987 BUDGET AUTHORIZATION

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
OPERATING EXPENSES				
Coal:				
Control technology and coal preparation:				
Coal preparation	12,716	6,443	+5,757	12,200
Flue gas cleanup	10,952	7,541	+5,759	13,300
Gas stream cleanup	7,105	3,839	0	3,839
Waste management	1,177	324	+53	861
Subtotal	31,950	18,147	+12,053	30,200
Advanced research and technology development, subtotal	33,849	27,224	+5,976	33,200
Coal liquefaction:				
Advanced research	5,157	2,620	+3,000	5,620
Indirect liquefaction	9,325	2,539	+4,011	6,550
Direct liquefaction	12,807	2,996	+10,304	13,300
Support studies/engineering evaluations	4,331	992	+38	1,030
Subtotal	31,620	9,147	+17,353	26,500
Combustion systems:				
Atmospheric fluidized bed combustion	16,572	1,590	+1,000	2,590
Pressurized fluidized bed combustion	5,061	3,686	+3,004	6,690
Advanced combustion technology	3,409	1,882	+1,998	3,880
Alternative fuels	4,071	2,011	+2,029	4,040
Subtotal	29,113	9,169	+8,031	17,200
Fuel cells:				
Phosphor acid systems	20,355	0	+14,877	14,877
Molten carbonate systems	9,932	3,400	+4,300	7,700
Advanced concepts	3,770	1,600	+3,000	4,600
Subtotal	34,057	5,000	+22,177	27,177
Heat engines and heat recovery, subtotal	12,314	7,942	+7,958	15,900
Underground coal gasification,	4,072	0	+2,000	2,000
Magnetohydrodynamics,	27,717	0	+23,500	23,500
Surface coal gasification:				
Advanced research	3,379	968	+3,252	4,220
Advanced process development	5,229	1,689	+3,461	5,150
System engineering concepts	27,949	1,373	+14,057	15,430
Environment and engineering analyses	2,113	1,131	+169	1,300
Great plains coal gasification project	2,653	437	−437	0
Subtotal	41,323	5,598	+20,502	26,100
Total, coal	246,015	82,227	+119,550	201,777
Petroleum:				
Advanced process technology:				
Advanced exploratory research	4,486	1,576	+3,924	5,500
Arctic and offshore research	1,037	235	+265	500
Subtotal	5,523	1,811	+4,189	6,000
Enhanced oil recovery:				
Heavy oil	2,756	608	+3,392	4,000
Light oil	7,381	3,876	+12,124	16,000
Tar sands	1,317	0	+2,000	2,000
Subtotal	11,454	4,484	+17,516	22,000
Oil shale subtotal	12,136	3,595	+8,405	12,000

FOSSIL ENERGY—FISCAL YEAR 1987 BUDGET AUTHORIZATION—Continued

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
Total, petroleum	29,113	9,890	+30,110	40,000
Gas:				
Unconventional gas recovery, subtotal	8,503	5,252	+4,748	10,000
Policy and management:				
Program direction:				
Headquarters program direction	13,380	11,260		
ETC program direction	39,265	28,740		
Total, policy and management	52,645	40,000	+8,300	48,300
Cooperative venture R&D pools, subtotal	0	12,500	−12,500	0
Total, operating expenses	336,276	149,869	+150,208	300,007
Capital equipment:				
Policy and management, subtotal	2,865	0	+4,450	4,450
Construction:				
Policy and management, subtotal	3,332	0	+4,000	4,000
Total, fossil energy	342,473	149,869	+158,658	308,527
(Operating expenses)	(336,276)	(149,869)	(+150,208)	(300,077)
(Plant and capital equipment)	(6,197)	(0)	(+8,450)	(8,450)

B. ENERGY CONSERVATION

The Energy Conservation activities funded in the Committee's recommendations include Building Systems, Community Systems, and Technology and Consumer Products in the Buildings and Community Systems Program; Waste Energy Reduction, Industrial Process Efficiency, and Industrial Cogeneration in the Industrial Energy Conservation Program; the Energy Related Inventions Program and Energy Conversion and Utilization Technologies (ECUT) in Multi-Sector Conservation Program; and Vehicle Propulsion, Electric & Hybrid Vehicle R&D, Alternative Fuels Utilization, Advanced Materials Development, High Temperature Materials Laboratory, and Program Direction in the Transportation Program.

The Department's fiscal year 1987 request for Energy Conservation totals $64,923,000, a decrease of $93,030,000 from the fiscal year 1986 appropriation of $157,953,000.

COMMITTEE VIEW

The Committee is concerned about the possible overlap and duplication of efforts funded by the Conservation Buildings and Community Systems program with those funded by the Solar Buildings Energy Systems program. Further, the Committee has been advised that no technical impediments exist to the merging of these two separate programs into one coherent, coordinated buildings program, and that there could well be considerable increases in management and administration efficiencies. Accordingly, begin-

ning in fiscal year 1988 and in subsequent years, the Department is directed to request funds for only one such buildings program.

COMMITTEE ACTIONS

Buildings and community systems

The Committee's recommendations for Buildings and Community Systems add $21,500,000 to the Department's request for a total authorization of $32,400,000 to provide: (1) $12,300,000 for Building Systems, including $3,000,000 for indoor air quality, with equal industry cost share; (2) $2,500,000 for Community Systems; (3) $12,600,000 for Technology and Consumer Products, including $8,000,000 for gas-fired heat pumps, $2,200,000 for advanced refrigeration, $1,800,000 for lighting and lighting impacts R&D, and $600,000 for combustion R&D; (4) $3,000,000 for Program Direction; and (5) $2,000,000 for capital equipment.

The Committee directs the Secretary of Energy and the Administrator of the Environmental Protection Agency to expeditiously pursue current studies of radon emissions associated with the Reading Prong. These studies include but are not limited to the following:

Development and Validation of Standardized Methods for Radon Mitigation, Testing and Diagnosis;

The Development and Demonstration of Radon Reduction Techniques for Existing Homes; and

Lung Cancer Risks from Radon Daughters in Domestic Environments.

This information shall be made available to the Committee and the public immediately after the data has been collected and analyzed. The Committee also encourages the DOE to compile the Maine, New Jersey, and Pennsylvania radon studies currently being conducted by DOE and EPA and analyze this collected data wherever feasible. This analysis would be in addition to the reports prepared from the data on the individual studies.

Acid Rain and Global Warming represent near-term and long-term problems, that pose substantial risks to the environment, economic productivity, and human health. The combustion of fossil and synthetic resources are known contributors to both problems. In addition, current patterns of energy use encourage increasing rates of emissions of other gases that could, taken together, hasten the onset of global warming by decades. Several studies have indicated that new, more energy-efficient technologies typically costing two to ten times less than new energy supply could play a significant role in reducing fossil fuel and synthetic combustion and thus contributing to the solutions to both problems.

The Department of Energy is to prepare a comprehensive report on the role that energy efficiency improvements could play in mitigating the problems of acid rain and global warming, in order to assist the potential for such energy-efficient technologies to reduce the emissions of gases contributing to acid rain and global warming in the U.S., the OECD countries, and the world as a whole. The report shall identify the policy options that might contribute to such reductions in emissions and shall discuss the economic implications of such actions. In preparing the report, DOE shall consult

other relevant federal agencies. The report shall be submitted to the Science and Technology Committee within six months of enactment of appropriated funds for FY 1987.

Industrial energy conservation

The Committee's recommendations for Industrial Energy Conservation add $20,516,000 to the Department's request for a total authorization of $35,639,000, including $10,000,000 for a steel technology research program, to provide: (1) $11,700,000 for Waste Energy Reduction; (2) $17,139,000 for Industrial Process Efficiency; (3) $5,000,000 for Industrial Cogeneration, which includes, but is not limited to, externally-fired Brayton system program continuation; and (4) $1,800,000 for Program Direction.

Thin-slab casting

The Committee stresses its view that the Bethlehem/U.S. Steel thin-slab casting project be fully funded in fiscal year 1987 within funds available under the Industrial Conservation program. The thin-slab casting project, now in its third year, offers the potential to significantly improve the production capability of the steel industry with considerable energy savings and productivity improvements. The pre-pilot phase will be completed in late 1987. The Committee expects all proof-of-concept testing to be performed. If the project is to be terminated short of the pilot plant, as proposed by the Department of Energy, $15.35 million in funding to date and $2 million in costs shared by the companies involved will have been wasted.

Steel research and development

The Committee recommendation includes $10,000,000 for FY 1987 for an innovative steel research program to develop what is known as "leapfrog" steel-making technologies. The program shall be conducted by the national laboratories, industry, and univesity scientists over the next five years under the sponsorship of the Department of Energy. The purpose of this program is to bring together the best talent, facilities and equipment available to conduct a basic research program to determine the technical feasibility of these innovative steel-making concepts.

This research initiative was developed in the Administration under the leadership of former Science Advisor to the President, Dr. George Keyworth. Witnesses have testified that new "leapfrog" steel-making technologies could result in energy savings as high as 30 percent.

The Committee is providing substantial support for this initiative and clear direction to the Department in light of the need to improve energy efficiency and increase the ability of the American steel industry to compete with steelmakers abroad. The need to introduce radical manufacturing technologies into steelmaking has been underscored by the National Academy of Sciences, the Office of Technology Assessment, as well as many other authorities.

The Committee recommendation delineates specific requirements for the innovative steel research program. Within 90 days of enactment, the Secretary would be required to publish a plan as part of the Department's energy conservation programs, prepared in con-

sultation with the National Bureau of Standards, the Bureau of Mines, and representatives of the industry and the universities who are to be involved in the research.

Priority would be given to four areas of research: (1) the reduction of domestic raw materials to liquid steel; (2) the production of near-net shape solids from liquid steel; (3) the development of universal grades of steel; and (4) the application of automatic processing technology.

The Secretary's plan would provide for open competition for all contract awards. The Committee's recommendation specifies that the Federal Government's share of the financing would not exceed 70 percent of the total cost of the project, with the remainder furnished in cash or in kind from non-federal sources. The Committee expects the steel industry to provide substantial support for this research a they have committed to do in hearings. The Committee notes that the Department has testified that for other government-industry projects, industry's share averages 25 percent.

The Committee's recommendation provides that knowledge gained from the research would be available only to participating companies and researchers involved in the program. The Committee intends that all proprietary rights of American companies would be protected. The Committee recommendation specifically provides that no trade secrets or commercial or financial information of the American companies furnished by the industry on a privileged or confidential basis in connection with this research shall be disclosed by the Government. The Committee expects strong steps to be taken to protect American industry from inadvertent or other disclosures of the knowledge gained to foreign competitors.

The Secretary would be required to submit an annual report to the President and the Congress on the research and development conducted under this section, and at the end of the five-year program, recommendations for further legislative, administrative and other actions needed.

The Committee's recommendation provides for the conclusion of the innovative steel research program at the end of fiscal year 1991, although the Committee recognizes that delays in starting the program may cause the end date to slip. The Committee expresses profound dismay at the Administration's proposal to defer start-up funds appropriated by Congress last year.

The Committee stresses that the need to accelerate this research is critical. The American steel industry is plagued with old plants and obsolete equipment. In contrast, almost all of Japan's steel is produced in new, efficient plants. The National Academy of Sciences has observed that, in the last 15 years in the American integrated steel industry, there has been a "global shift" of technological leadership from the United States to Japan. This is evidenced by steel imports into this country that have gone from 15 percent in 1979 to 25 percent in 1985, contributing to the closing of many American mills and the disintegration of many American communities.

New technology may not be the salvation of the American steel industry, but the need for improving American steelmaking technology in light of our foreign competition is abundantly clear. This

research initiative brings together those with a stake in the industry's future and those with the expertise into one setting around one common goal. A strong steel industry is fundamental to the Nation's defense and economy. The Committee feels strongly that government, industry and the universities must work together toward this common goal.

When referring to participating companies, particular emphasis should be given to American companies who are substantially involved in the U.S. domestic production of steel and have a substantial percentage of their operations located within U.S. borders. It is also important to note that the American steel industry should be further clarified as companies located within U.S. borders and that any technology or information developed through this initiative will be used on U.S. domestic steel operations and not on subsidiaries overseas, to combat the current competitive advantage of foreign steelmakers.

Multi-sector conservation

The Committee's recommendations for Multi-Sector Conservation add $5,650,000 to the Department's request for a total authorization of $24,750,000 to provide: (1) $4,250,000 for the Energy Related Inventions Program; (2) $19,900,000 for Energy Conversion and Utilization Technologies (ECUT); (3) $500,000 for ECUT Program Direction; and (4) $100,000 for capital equipment. Within the $19,900,000 provided for the Energy Conversion and Utilization Technologies (ECUT) program, $500,000 should be provided for continuation of a Catalysis/Biocatalysis program, through initiation of laboratory work, at the Idaho National Engineering Laboratory (INEL); and $1,000,000 should be provided for an Advanced Process Research Initiative on raw and intermediate materials at the Idaho National Engineering Laboratory (INEL).

Transportation R&D

The Department of Energy requested $19.8 million for Transportation R&D in fiscal year 1987. This amount is 65% less than the amount for fiscal year 1986, after Gramm-Rudman-Hollings reductions.

COMMITTEE ACTIONS

Despite Congressional intention to continue the Stirling proof-of-concept demonstration, as indicated both in recent authorizations and appropriations, the Department of Energy has again proposed termination of the project. The Committee believes this action is short-sighted, particularly in light of the program's significant achievements to date. Accordingly, the Committee recommends $12,000,000 to complete the development and characterization of the Mod II engine. The Committee understands that fiscal year 1987 will be the last year of the Stirling engine contract.

Although the Automotive Gas Turbine Engine (AGT) program, to be completed in fiscal year 1986, will demonstrate the feasibility of the engine concept, further research and development on ceramic components processing and reliability is required. Therefore, the Committee recommends $12,500,000 to utilize the engines devel-

oped under the AGT program as test beds for an Advanced Turbine Technology Applications Project (ATTAP). The ATTAP will incorporate the results of the Advanced Materials Development program to enhance the development of analytic tools for the ceramic properties experimental data base, the development of processes for the fabrication and testing of ceramic components, and the evaluation of the reliability and durability of the next generation of high temperature ceramics. The Committee recommends that cost-share arrangements be negotiated to allow both contractor teams to be retained for the ATTAP program.

The Committee continues to support the goals of the Methane Transportation Research, Development and Demonstration Act of 1980. Accordingly, the Committee recommends $240,000 to complete methane performance and emissions evaluations and to update the methane information data base.

Budget requests for developing electric and hybrid vehicle technology have declined sharply in recent years. Yet, the Committee believes the underlying reasons for passage of the Electric Vehicle Research, Development and Demonstration Act of 1976 remain valid. Accordingly, the Committee recommends an increase in several programs with great potential for advancing electric vehicle technology. These programs include the Site Operators Users Task Force ($500,000), test and evaluation conducted by the Idaho National Engineering Laboratory ($1,500,000), lead-acid battery research and development ($700,000), zinc-bromine battery research and development ($500,000), sodium-sulfur battery research and development ($500,000), and the Advanced A.C. Propulsion System (ETX-II) Project ($2,500,000). The total increase recommended for Electric Vehicles is $6,200,000.

Fiscal year 1987 represents the third year of a five-year DOE "Ceramic Technology for Advanced Heat Engines Program Plan" established in 1984. While funding levels in the initial years were close to the proposed targets, the fiscal year 1987 request represents less than one-half the targeted level of the long-range program plan. Failure to fund at the full level of the program plan will cause reductions or elimination of research in the following areas: powder synthesis, monolithic processing, ceramic composites, non-destructive evaluation techniques, failure and life prediction analysis, and special coatings. The Committee does not believe it reasonable to assume that the private sector will conduct the research represented by these program. As such, the Committee recommends an additional $6,000,000 for a total of $12,500,000 to more closely comply with the goals of the long-term program plan.

Appropriated funds for construction and special equipment for the High Temperature Materials Laboratory, a new national user facility, totaled $19,600,000 over the past several years with the laboratory scheduled for completion in February 1987. While no further construction or equipment monies for this facility were requested in the fiscal year 1987 budget, operational support will be required. The Department has recommended that responsibility for operational support of the HTML—estimated at $1,000,000 in fiscal year 1987—be transferred from the Department's Office of Conservation and Renewable Energy (OCR) to the Office of Energy Research (OER). While the budget indicates subtraction of the oper-

ational monies from OCR, no commensurate amount appears in the budget for OER. While a small amount in the overall budget, the Committee believes it would be extremely unfortunate should operational support for this national user facility be lost or substantially reduced as a result of the proposed transfer of responsibility. The Committee further believes it unwise to transfer management responsibility at a juncture where the HTML is not fully operational and when appropriate funds have not been provided in the OER budget. As such, the Committee recommends that the decision to transfer responsibility for the HTML to OER be postponed until fiscal year 1988 and that such decision be reevaluated at that time. In order to assure maximum use of the HTML as a national user facility, the Committee included $1,000,000 to provide for full-time, permanently assigned operators of the specialized laboratories and equipment of HTML. The Committee requests that operational support of HTML appear as a line item in future budget requests.

The Committee further recommends an increase of $500,000 to the Program Direction line to provide for Department of Energy civil service staffing requirements at the fiscal year 1986 level (36 positions).

COMMITTEE VIEWS

Advanced ceramics program plan

Advanced structural ceremics have emerged in the past several years as critical to our national strategic and economic interests. Testimony before the Subcommittee indicated that structural ceramics could contribute as much as $15 billion annually to the GNP by 1995 and provide close to 200,000 new jobs. On the other hand, failure to achieve a technological dominance in this field will cost the U.S. more than $10 billion annually and add more than 100,000 jobs to our unemployment by that same year.

A recent study by the National Academy of Engineers, "High-technology Ceramics in Japan", indicates that Japan has taken aggressive steps to advance in this key area. It is estimated that more than 60 Japanese companies are actively engaged in ceramics research and development with estimated funding of between $100 million to $300 million annually. The Ministry of International Trade and Industry (MITI) in 1981 targeted high-performance ceramics as one of several R&D projects "on basic technology for future industries" and created a 10-year industry-government program with established goals and performance to dominate this market internationally.

While U.S. R&D funding levels of approximately $100 million for structural and electronic ceramics would appear competitive, our failure to properly organize our research activities with established goals, benchmarks and funding levels is eroding our original lead in this field. Even when such program plans are created, administrative and political actions have undercut implementation. A case in point is the five-year DOE "Ceramic Technology for Advanced Heat Engines Program Plan" established in 1984. While the initial years of the program were relatively successful, recent funding levels have failed to meet the original targeted levels with predictable effects on the proposed goals of the program. Within DOE, the

fiscal year 1987 request of $6,500,000 is less than half of the targeted level; within the National Aeronautics and Space Administration (NASA), none of the targeted funding levels have been requested.

Because of the importance of advanced structural ceramics, the Committee feels strongly that the Federal Government, working closely with our industry and academia, should establish and maintain a strong technological, as well as scientific, dominance in this field. As such, the Committee requests that the Department of Energy, acting as lead agency, and working collaboratively with NASA, the Department of Defense and other appropriate Federal agencies, establish a research and development program plan for advanced structural ceramics. The Department is requested to report to the Committee no later than October 1, 1986, a program plan to include:

Program goals and priorities of individual agencies;

Technical milestones and requirements to achieve the program goals;

Assignment of responsibility among the agencies and/or individual institutional elements;

A description of methodology of coordination and technology transfer;

A description of current as well as proposed funding levels for the next five years for each of the participating agencies;

Proposed participation by industry and academia in the planning and implementation of this program.

Recognizing the existence of the National Critical Materials Council and its requirement to establish a national Federal program plan for advanced materials research and development, the Committee expects DOE to work closely with the Council in arriving at its final program plan. The Committee also expects that the advanced ceramics program plan would become an important subelement of the required advanced materials program plan.

Hydrogen R&D

Recent hearings on hydrogen research and development showed that DOE's hydrogen R&D programs, while remaining approximately level in current dollars, are substantially reduced when inflation is considered. DOE estimates that $30,900,000 was spent in fiscal year 1981. Exact figures remain unavailable for fiscal year 1986 and fiscal year 1987, though no change in the fiscal year 1985 level were indicated. The vast majority of these monies ($19,600,000) is provided as "non-mission related" funds focused on basic R&D. Only $3,800,000 is actually applied R&D oriented specifically to hydrogen and focused on production, storage or conversion. Within DOE, hydrogen R&D is conducted by more than eight different groups with no recognizable development of goals or priorities at a Federal or even a Departmental level. While a DOE Hydrogen Energy Coordinating Committee does exist, the principal purpose of the Committee appears to be to compile figures on past spending history, rather than to be forward looking as to the long-term goals or priorities of the Department. There appears to be no coordination between the DOE programs and the more than $57,800,000 proposed for expenditure in hydrogen-related activities

of NASA. Finally, no formal outside advisory mechanism exists to aid in developing long-term goals or priorities.

Given the importance of hydrogen as a potential energy source of the future, the Committee believes it important that the Department of Energy move forward in defining appropriate goals and priorities for hydrogen R&D and take the lead role in coordinating that R&D with other appropriate agencies including NASA and DOD. As such, the Committee requests that DOE in conjunction with NASA establish a comprehensive five-year program plan for hydrogen R&D. The plan should be made available no later than October 1, 1986, and should include:

1. Goals and priorities of individual agencies and programs within agencies;
2. The technical milestones and requirements to achieve those goals and priorities;
3. The assignment of responsibility for conducting the R&D;
4. The formal methodology for coordination and technology transfer;
5. The current and proposed funding requirements for the next five years for each of the agencies and research groups; and
6. The participation by industry in the planning and implementation of the program plan, including the consideration of appropriate outside advisory panels.

DETAILED SUMMARY

Details of the Committee's recommendations, current year estimates and the budget request for Energy Conservation are shown on the following tables:

ENERGY CONSERVATION—FISCAL YEAR 1987 BUDGET AUTHORIZATION

[In thousands of dollars]

	Fiscal year—		Committee action	
	1986 estimated	1987 DOE request	Change to DOE request	Recommendation
Building and community systems:				
Building systems: Operating expenses	12,099	3,500	+8,800	12,300
Community systems: Operating expenses	3,727	0	+2,500	2,500
Technology and consumer products: Operating expenses	10,053	5,000	+7,600	12,600
Program direction: Operating expenses	3,557	2,400	+600	3,000
Subtotal, operating expenses	29,436	10,900	+19,500	30,400
Capital equipment	1,863	0	+2,000	2,000
Subtotal, buildings and community	31,299	10,900	+21,500	32,400
Industrial energy conservation:				
Waste energy reduction: Operating expenses	11,174	6,300	+5,400	11,700
Industrial process efficiency: Operating expenses	19,551	5,479	+11,660	17,139
Industrial cogeneration: Operating expenses	4,377	1,500	+3,500	5,000
Program direction: Operating expenses	2,016	1,844	−44	1,800
Subtotal, industrial energy conservation	37,118	15,123	+20,516	35,639
Multisector conservation:				
Energy related inventions program: Operating expenses	4,653	3,300	+950	4,250
Energy conversion and utilization technologies [ECUT]: Operating expenses	18,097	15,200	+4,700	19 900

ENERGY CONSERVATION—FISCAL YEAR 1987 BUDGET AUTHORIZATION—Continued

[In thousands of dollars]

	Fiscal year—		Committee action	
	1986 estimated	1987 DOE request	Change to DOE request	Recommendation
Program direction [ECUT]: Operating expenses	498	500	0	500
Operating expenses	23,248	19,000	+3,150	22,150
Capital equipment	930	100	0	100
Subtotal, multisector conservation	24,178	19,100	+5,650	24,750
Facilities: construction	9,608	0	0	0
Transportation R&D:				
Vehicle propulsion R&D: Operating expenses	32,085	6,500	+23,000	29,500
Electric and hybrid vehicle R&D: Operating expenses	8,586	4,140	+6,200	10,340
Alternative fuels utilization: Operating expenses	1,489	1,260	+240	1,500
Advanced materials development: Operating expenses	8,646	6,500	+6,000	12,500
High Temperature Materials Laboratory: Operating expenses	0	0	+1,000	1,000
Program direction: Operating expenses	2,140	1,400	+500	1,900
Subtotal, operating expenses	52,946	19,800	+36,940	56,740
Capital equipment	0	0	+1,000	1,000
Construction	2,804	0	0	0
Subtotal, transportation R&D	55,750	19,800	+37,940	57,740
Total, energy conservation	157,953	64,923	+85,606	150,529
(Operating expenses)	(142,748)	(64,823)	(+82,606)	(147,429)
(Plant and capital equipment)	(15,205)	(100)	(+3,000)	(3,100)

C. ENERGY SUPPLY RESEARCH AND DEVELOPMENT

The Energy Supply R&D programs funded in the Committee's recommendations are Renewable Energy R&D programs, Nuclear Fission R&D, Magnetic Fusion Energy, Supporting Research and Technical Analysis, and Environmental R&D. The Department of Energy's fiscal year 1987 request for these activities totals $1,572,739,000, a decrease of $115,798,000 from the fiscal year 1986 appropriation of $1,688,537,000.

1. Renewable Energy R&D

The Renewable Energy activities solely under the Committee's jurisdiction include Solar Buldings Energy Systems, Photovoltaic Energy Systems, Solar Thermal Energy Systems, Biofuels Energy Systems. Wind Energy Systems, Ocean Energy Systems, the Solar Energy Research Institute, Solar Program Support, Solar Resource Assessment, Solar Program Direction, Geothermal Energy, and Electric Energy Systems and Energy Storage Systems.

a. Solar Energy

COMMITTEE VIEWS

The Committee shares the concern expressed in the December 1985 *Report of the Solar Panel of the Energy Research Advisory Board to the United States Department of Energy* that "the fraction

of funds available for industry and university research has disproportionately decreased, with a potential negative impact on the program's ability to meet long-term goals." The Department is directed to report to the Committee, by October 1, 1986, how it plans to correct this imbalance in the program.

Solar buildings energy systems

The Committee is concerned about the possible overlap and duplication of efforts funded by the Solar Buildings Energy Systems program with those funded by the Conservation Building and Community Systems program. Further, the Committee has been advised that no technical impediments exist to the merging of these two separate programs into one coherent, coordinated buildings program, and that there could well be considerable increases in management and administration efficiencies. Accordingly, beginning in fiscal year 1988 and in subsequent years, the Department is directed to request funds for only one such buildings program.

Biofuels energy systems

The Committee agrees with the recommendation of the December 1985 *Report of the Solar Panel of the Energy Research Advisory Board to the United States Department of Energy* that the "Biofuels Program is relatively disorganized. The number of laboratories involved in management functions should be reduced, the roles of the various research laboratories clarified and the research focused." Accordingly, by October 1, 1986, the Department is to provide a report to the Committee which will specify how the existing disorganization has been eliminated, how the number of laboratories involved in management functions has been reduced, how the roles of the various research laboratories have been clarified, and how the research has been focused.

Wind energy systems

The Committee agrees with industry and laboratory representatives that the hoped-for utility market for multi-megawatt wind systems is still some years away, and that there is little possibility that in the near term, the private sector will see any reason to spend the huge amounts of money needed to bring a commercial multi-megawatt system into being. Accordingly, with the exception of the MOD 5-B, the Department is urged to immediately cease testing all multi-megawatt wind machines. No fiscal year 1987 funds are to be used for the purpose of tsting multi-megawatt wind machines, and no funds shall be used to develop a multi-megawatt system following testing of the MOD 5-B. Any further testing of machines in the multi-megawatt size range should be carried out on turbines in the field via cooperative agreements with manufacturers or wind-farms.

COMMITTEE ACTIONS

Solar buildings energy systems

The Committee's recommendations for Solar Buildings Energy Systems add $3,250,000 to the Department's request for a total authorization of $7,950,000 to provide: (1) $3,600,000 for Materials and

Components Research; (2) $3,350,000 for Systems Research and Development, including $1,300,000 for apertures-related R&D and $650,000 for transfer of solar buildings energy technology to industry; and (3) $1,000,000 for innovative concepts with emphasis on university research.

Photovoltaic energy systems

The Committee's recommendations for Photovoltaic Energy Systems add $21,358,000 to the Department's request for a total authorization of $41,958,000 to provide: (1) $31,000,000 for Materials Research, including $16,000,000 for Single Junction Films, $9,000,000 for High Efficiency Multijunction Concepts, and $6,000,000 for Innovative Concepts; (2) $7,000,000 for Collector Research, including $4,000,000 for Concentrator Collectors; (3) $1,000,000 for Systems Research for Module Reliability; (4) $2,000,000 to provide necessary new and replacement research equipment to guarantee state-of-the-art capabilities for SERI, university and small business participants in the Photovoltaic program which are required in this technical research area; and (5) $958,000 for innovative concepts with an emphasis on participation by university researchers.

Solar thermal energy systems

The Committee's recommendations for Solar Thermal Energy Systems add $8,700,000 to the Department's request for a total authorization of $24,000,000 to provide: (1) $10,650,000 for Collection Technology Research; (2) $4,350,000 for Energy Conversion Technology Research; (3) $7,750,000 for Systems and Applications Technology Research; (4) $250,000 for Planning and Assessment; and $1,000,000 for university research.

Within the $10,650,000 provided for Collection Technology Rsearch, $890,000 shall be designated for solar bowl studies. The $890,000 designated for solar bowl studies shall not be available for obligation until all of the following conditions are met: the current Crosbyton Solar Power Project work contract is completed; the final report of work is completed and released to the Department of Energy; and the evaluation of the solar bowl technology relative to the other solar thermal technologies is complete. Upon review of the evaluation, the Department shall make a determination on the obligation of the funds.

The Committee strongly supports the Department's Innovative Point Focus Solar Concentrator Program. Accordingly, within available funds, the Department is directed to support a third Phase II Innovative Point Focus Solar Concentrator Program project utilizing the refractive lens concept at the level of $1,300,000.

Biofuels energy systems

The Committee's recommendations for Biofuels Energy Systems add $12,900,000 to the Department's request for a total authorization of $25,100,000 to provide: (1) $5,200,000 for Production Research, including $2,500,000 for Short Rotation Intensive Culture, $1,400,000 for Herbaceous Energy Crops, and $1,300,000 for Aquatic Species; (2) $9,200,000 for Thermochemical Conversion; (3)

$7,100,000 for Biochemical Conversion, including $1,350,000 for 50/50 funding with the Gas Research Institute to biologically convert organic matter to methane at an existing experimental test unit at Walt Disney World, Orlando, Florida, to complete the project's funding requirements; and (4) $3,000,000 for Advanced Concepts to initiate a joint Department of Energy laboratory-univesity program to investigate light-conversion processes, other than photovoltaics, that could lead to the direct production of useful fuels or chemicals.

Wind energy systems

The Committee's recommendations for Wind Energy Systems add $8,750,000 to the Department's request for a total authorization of $17,000,000 to provide: (1) $7,580,000 for Basic Science of Wind Turbine Dynamics, an increase of $2,000,000 to the Department's request, for increased efforts on Atmospheric Fluid Dynamics and Aerodynamics Research to be carried out primarily in universities; (2) $4,750,000 for Advanced Components and Supporting Research, an increase of $2,250,000 to the Department's request for enhancement of the Cooperative Field Test Program and for Wind/Diesel and Remote Power Systems Research; and (3) $4,500,000 for the MOD 5–B.

With regard to the MOD 5–B, $4,500,000 is provided to test the unit because a large percentage of the funding for fabrication, installation, and testing of the unit has already been appropriated and spent, and the project should be completed. However, no additional funds shall be expended on the machine, beyond those for testing, in the event of mechanical failure.

Ocean energy systems

The Committee's recommendations for Ocean Energy Ssytems add $1,700,000 to the Department's request for a total authorization of $4,200,000 to provide: (1) $200,000 for Materials and Structures Research to develop and evaluate cold water pipe effects; (2) $1,500,000 for Thermodynamic Research and Analysis to increase efforts to validate open cycle analytical models, evaluate mist lift, wave and latent concepts, and complete a conceptual design for a 165 kilowatt-electric open cycle plant, at an estimated cost of $1,000,000; and (3) $2,500,000 for Experimental Verification and Testing to experimentally validate open-cycle Ocean Thermal Energy Conversion processes in seawater, and to conduct materials degradation experiments. No fiscal year 1987 funds shall be used for purchase of the cold water pipe for the Sea Coast Test Facility upgrade.

Solar Energy Research Institute (SERI)

The Committee supports the Department's request for the Solar Energy Research Institute of $545,000, including $315,000 for capital equipment and $230,000 for construction.

Solar program support

The Committee supports the Department's request for Solar Program Support of $897,000 for operating expenses.

Solar resource assessment

The Committee supports the Department's request for Solar Resource Assessment of $700,000 for operating expenses.

Solar program direction

The Committee supports the Department's request for Solar Program Direction of $4,100,000 for operating expenses.

b. Geothermal Energy

COMMITTEE ACTIONS

The Committee's fiscal year 1987 recommendations for Geothermal Energy add $6,807,000 to the Department's request to provide: (1) $4,557,000 for Geopressured Resources; (2) $19,400,000 for Geothermal Technology Development; and (3) $780,000 for Program Direction.

The $19,400,000 designated for Geothermal Technology Development is to be allocated as follows: (1) $8,000,000 for Hot Dry Rock Research to complete the design, purchase, and construction of the surface system in order that the program may proceed to a logical conclusion; (2) $8,000,000 for Hydrothermal Research; (3) $2,400,000 for Hard Rock Penetration Research; and (4) $1,000,000 for Magma Enegry Extraction Research.

The funding for Geopressured Resources shall include at least $1,557,000 for flow testing for geopressured design wells and for test analysis in cooperation with the Electric Power Research Institute (EPRI).

The Geothermal Energy Division of the Conservation and Renewable program is directed to provide a total of $3.3 million, within funds available, for the continuation of the Salton Sea Scientific Drilling Project (SSSDP). Of these funds, $2 million from funds in excess of $23.7 million are to be applied to deepening the geothermal well at Salton Sea to a depth of 13,000 to 14,000 feet in the pursuit of basic science. Technical support will be provided by the Office of Energy Research.

c. Electric Energy Systems and Energy Storage Systems

The Electric Energy Systems program supports research aimed at increasing the efficiency, reliability, and adapability of our nation's electric power transmission and distribution systems. The R&D programs principally focus on: providing technical options that will enhance the reliability of the electric network under normal and emergency situations, particularly that of an electromagnetic pluse, improving system efficiency through the development of new materials, advanced controls, new design concepts; and determining the biological health effects of exposure to high-voltage electric fields.

The Energy Storage Systems program shares a common goal with the Electric Energy Systems program of developing a technology base for providing a continuous supply of electric power in a safe, reliable and efficient manner. The program is intended to bridge the gap between fundamental research and private sector product development and it supports end-use applications which in-

clude electric vehicles, utility load leveling, and building and industrial conservation. The program is divided into two major subcategories, electrochemical energy storage and thermal and mechanical storage.

Electrochemical storage (battery storage) is intended to provide advanced batteries and conversion technologies that can facilitate the substitution of domestic energy resources for imported energy resources and allow more efficient use of domestic resources. The program has two main subactivities: technology base research, which includes research on new and improved systems which are cross-cutting activities to support the development of all existing energy storage and conversion systems. The second subcategory is advanced development and testing which focuses on sodium-sulfur and zinc-bromine battery development.

The goal of the Thermal Energy Storage program is to develop technology which will enable the storage and control of available heat for use at a later time. This facet of the storage program is particularly attractive for use in load leveling and contains work on phase change and latent heat technologies.

COMMITTEE ACTIONS

Electric Energy Systems

The Committee's recommendations for Electric Energy Systems add $8,700,000 to the Department's request for a total authorization of $16,319,000 to provide: (1) $2,800,000 for Electric Field Effects, an increase of $200,000 to be used to continue biological research on electric field effects; (2) $2,800,000 for Reliability Research, including $1,000,000 to enhance work on Electromagnetic Pulse (EMP) effects; (3) $10,369,000 for Systems Technology; and (4) $350,000 for Program Direction.

The Systems Technology category was most severely impacted in the Department's budget proposal with a recommended decrease in funding of $2,800,000. Of the seven major elements within the Systems Technology category, six were recommended for termination and only three of those requested close-out funding. The Committee's recommendations restore $500,000 to continue the Athens Automation Processing Activity which will enable this project to complete testing and analyze test data; $2,000,000 to new materials research, including $400,000 to continue work on metal oxide varistors/amorphous metals for motors and transformers, and $1,600,000 to continue work on dielectric insulators; and $4,700,000 for the Hawaii Deep Water Cable program. An additional $300,000 is provided in support of the Battery Energy Storage Test (BEST) facility to allow DOE to continue its efforts in cooperation with the Electric Power Research Institute (EPRI) and New Jersey Public Service Gas and Electric. The Committee believes that this demonstration work is important and encourages the Department of Energy to continue its participation in this program.

d. Energy Storage Systems

The Committee's recommendations for Energy Storage Systems add $6,000,000 to the Department's request for a total authoriza-

tion of $14,600,000 to provide: (1) $11,201,000 for Battery Storage; (2) $3,000,000 for Thermal and Mechanical Storage; and (3) $399,000 for Program Direction. The Committee believes that the additional funding will provide the necessary continuity to conduct a responsible research and development program.

Within the total provided for Battery Storage, $1,000,000 is to be used to identify, characterize and improve materials and components for use in batteries, an additional $1,300,000 is to be directed to ongoing development work on fuel cells for transportation applications, and an additional $1,000,000 is provided for the aluminum/air battery. The Department of Energy has determined that it will no longer be an active participant in the development of the zinc-bromine battery and that the DOE efforts will be concentrated on sodium- sulfur battery development. The Committee views the continuation of the three- year, cost-shared zinc-bromine battery project development as a priority, and recommends that at least $700,000 be directed to this project to maintain DOE's integral role in this joint effort with EPRI and the private sector, with activity expected to focus on optimizing system efficiency and long-term component stability, fabrication and testing. The Committee believes that the utilization of the test facility at Argonne National Laboratory is an important step in advanced battery development and recommends that $500,000 be directed to allow continued testing at the facility.

The $1,500,000 increase to Thermal and Mechanical Storage is to be used for Thermal Storage to continue exploratory development of new materials to provide a base for advanced thermal storage systems for use in residential, commercial, industrial and utility applications. Of this funding, $1,000,000 should be directed to continue work on the composite phase change materials for thermal energy storage technology research currently ongoing.

DETAILED SUMMARY

Details of the Committee's recommendations, current year estimates and the budget request for Renewable Energy R&D are show on the following table:

RENEWABLE ENERGY— FISCAL YEAR 1987 BUDGET AUTHORIZATION

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
SOLAR ENERGY				
Solar buildings energy systems:				
Operating expenses	7,700	4,700	+3,250	7,950
Capital equipment	481	0	0	0
Subtotal, solar buildings energy systems	8,181	4,700	+3,250	7,950
Photovoltaic energy systems:				
Operating expenses	39,523	19,600	+20,358	39,958
Capital equipment	1,155	1,000	+1,000	2,000
Subtotal, photovoltaic energy systems	40,678	20,600	+21,358	41,958

RENEWABLE ENERGY— FISCAL YEAR 1987 BUDGET AUTHORIZATION—Continued

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
Solar thermal energy systems:				
Operating expenses	25,596	15,300	+8,700	24,000
Capital equipment	289	0	0	0
Subtotal, solar thermal energy systems	25,885	15,300	+8,700	24,000
Biofuels energy systems:				
Operating expenses	26,749	11,600	+12,900	24,500
Capital equipment	577	600	0	600
Subtotal, biofuels energy systems	27,326	12,200	+12,900	25,100
Wind energy systems:				
Operating expenses:				
Basic science of wind turbine dynamics	6,530	5,580	+2,000	7,580
Advanced components and supporting research	5,978	2,500	+2,250	4,750
MOD 5–B	11,547	0	+4,500	4,500
Subtotal, operating expenses	24,055	8,080	+8,750	16,830
Capital equipment	770	170	0	170
Subtotal, wind energy systems	24,825	8,250	+8,750	17,000
Ocean energy systems: Operating expenses	4,811	2,500	+1,700	4,200
Solar Energy research Institute:				
Capital equipment	251	315	0	315
Construction	1,993	230	0	230
Subtotal, Solar Energy Research Institute	2,244	545	0	545
Solar program support: operating expenses	1,251	897	0	897
Solar resource assessment:				
Operating expenses	914	700	0	700
Capital equipment	48	0	0	0
Subtotal, solar resource assessment	962	700	0	700
Program direction: operating expenses	4,516	4,100	0	4,100
Subtotal, solar energy	140,679	69,792	+56,658	126,450
(Operating expenses)	(135,115)	(67,477)	(+55,658)	(123,135)
(Plant and capital equipment)	(5,564)	(2,315)	(+1,000)	(3,315)
GEOTHERMAL ENERGY				
Hydrothermal industrialization: operating expenses	1,525	0	0	0
Geopressured resources: operating expenses	4,426	3,000	+1,557	4,557
Geothermal technology development:				
Operating expenses	19,548	14,150	+5,250	19,400
Capital equipment	481	0	0	0
Subtotal, geothermal technology development	20,029	14,150	+5,250	19,400
Program direction: Operating expenses	701	780	0	780
Subtotal, geothermal energy	26,681	17,930	+6,807	24,737
(Operating expenses)	(26,200)	(17,930)	(+6,807)	(24,737)
(Plant and capital equipment)	(418)	(0)	(0)	(0)
ELECTRIC ENERGY SYSTEMS AND STORAGE				
Electric field effects: Operating expenses	2,887	2,600	+200	2,800
Reliability R&D: Operationg expenses	2,886	1,800	+1,000	2,800
Systems technology: Operating expenses	5,418	2,869	+7,500	10,369

RENEWABLE ENERGY— FISCAL YEAR 1987 BUDGET AUTHORIZATION—Continued

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
Program direction: Operation expenses	356	350	0	350
Subtotal, electric energy systems	11,548	7,619	+8,700	16,319
ENERGY STORAGE SYSTEMS				
Battery storage:				
Operating expenses	13,828	6,701	+4,500	11,201
Capital equipment	192	0	0	0
Subtotal, battery storage	14,020	6,701	+4,500	11,201
Thermal and mechanical storage: Operating expenses	2,945	1,500	+1,500	3,000
Program direction: Operating expenses	327	399	0	399
Subtotal, energy storage systems	17,292	8,600	+6,000	14,600
Total, electric energy systems and storage	28,840	16,219	+14,700	30,919
(Operating expenses)	(28,648)	(16,219)	(+14,700)	(30,919)
(Plant and capital equipment)	(192)	(0)	(0)	(0)
Total, renewable energy	196,200	103,941	+78,165	182,106
(Operating expenses)	(189,963)	(101,626)	(+77,165)	(178,791)
(Plant and capital equipment)	(6,237)	(2,315)	(+1,000)	(3,315)

2. Nuclear Fission R&D

Nuclear Fission R&D programs under the Committee's sole jurisdiction include: (1) Nuclear Energy R&D; (2) the Civilian By products and Beneficial Uses and Waste Treatment activities of the Remedial action and Waste Technology Program; and (3) Civilian Radioactive Waste R&D.

The Department's fiscal year 1987 request for Nuclear Fission R&D totals $337,400,000, a decreae of $65,365,000 from the fiscal year 1986 appropriation of $402,765,000.

COMMITTEE VIEWS

The Committee is concerned about the level of the fission budget as well as the direction of the fission program. Unfortunately, it appears that the Department is reluctant to pursue any civilian reactor R&D activity vigorously which might lead to a reactor test project for a promising design even if such a project would involve significant industry and utility cost-sharing.

The Committee's recommendations restore only a fraction of the cuts from fiscal year 1986 because of the constraints of this deficit reduction climate. Nevertheless, the Committee has attempted to provide direction, enhanced focus and a better balance to the fission R&D program. The redirection of additional funds in Advanced Converter Reactor Technology are intended to address the imbalance between defense and civilian reactor R&D. Further, the Committee believes that cost-shared test reactor projects, e.g., for the Modular High Temperature Gas-Cooled Reactor and Innovative

Liquid Metal Reactors, are consistent with the Federal role in R&D. However, the DOE should not allow focus on such a project to result in rejection of alternative nuclear technologies because of near-term budget constraints. This would be particular unfortunate in view of the recent industry interet in passively safe and smaller reactors.

The Committee recognizes that the space nuclear development and certain defense terrestrial R&D activities offer synergistic benefits to the civilian R&D program. Nevertheless, the Committee recommends that the DOE carefully review any possibilities for cost-sharing by the Department of Defense in facility support for such programs. The Committee further recognizes that serveral of the DOE's nuclear fission facilities are world class and the Department should develop appropriate R&D programs to justify their operation. The Committee strongly urges the Department to strive for optimum use of nuclear facilities across the spectrum of civilian and defense related R&D.

In the Light Water Reactor area, the Committee recognizes the supportive Energy Research Advisory Board recommendations made to the DOE but is not convinced that R&D dollars should be spent in safety and a licensing activity that is chiefly of an institutional nature. The Committee suggests that the Assistant Secretary of Nuclear Energy recommend use of other Department funds for such purposes if these are truly priority activities.

Finally, the Committee reminds the Department that the National Laboratories are a national asset and their role as unique reservoirs of interdisciplinary expertise should not be sacrificed to address short-term budgetary concerns. The DOE should program some serious institutional planning about the laboratories' future role in nuclear development. Also, the future of the neclear option requires significant industry involvement as a partner with the National Laboratories and the universities. The Committee does not believe that the future of the nuclear option rests solely on the near-term prospects for Light Water Reactor orders. Program planning must retain the technology development flexibility to meet a range of market place scenarios in the 1990's and beyond.

COMMITTEE ACTIONS

a. Nuclear Energy R&D

The Department of Energy's fiscal year 1987 budget request for Nuclear Energy R&D programs has been structured into seven program categories: (1) Light Water Reactors; (2) Advanced Reactor Research and Development; (3) Space and Defense Power Systems; (4) Advanced Nuclear Systems; (5) Facilities; (6) Water Cooled Breeder: (7) Program Direction. Upon reviewing the Department's request, the Committee finds that the restructuring of budget categories as delinated in the fiscal year 1987 budget request, obscures the actual distribution of funding among the various subactivities that comprise the Civilian Reactor Development Program and the Sapce and Defense Reactor Development Programs, as previously considered by the Committee in its deliberations on the fiscal year 1986 budget request (House Report 99-54 and House Report 99-55,

Part 1). For this reason, the authorization recommendations presented in this report were structured in accordance with the programmatic breakdown provided to the Committee in last year's budget review. B so doing, it is made clear that certain activities that were approved by this Committee in fiscal year 1986 have been either augmented or decreased in the Department's fiscal year 1987 budget request. Actions thus could then be taken and recommendations made that support Committee directives as specified in the authorization deliberations of last year. It is also apparent in the Committee's recommendations that the allocation of funds among the various laboratories and test facilities can be readily compared to funds allocated in direct support of program activities in the Nuclear Fission Research and Development Program.

(1) Improved Light Water Reactor Technology

The Committee's recommendations delete $5,000,000 from the Department's request for a total authorization of $6,000,000 for Improved LWR Development, including $5,000,000 for the "Reactor Code Assessment Program". The Committee supported the Department's request for $12,000,000 for the Three Mile Island R&D for continuation of R&D work in connection with cleaning-up the Three Mile Island nuclear plant.

Improved LWR development

The Committee's recommendations delete $5,000,000 in operating funds for Improved LWR Development for work pertaining to "institutional reforms," and redirect these funds to Advanced Light Water Reactor Technology. The Committee recognizes the need for licensing reform, enhanced construction practices, in-plant fabricated reactor systems, reductions in plant maintenance requirements and improvements in productivity. However, the Committee does not believe that the Department of Energy can make major contributions to correcting problems which are clearly the responsibility of other Federal institutions and require a clear policy directive from the White House.

On the other hand, the Committee does understand that personnel from the Department could, under certain circumstances, act as catalysts in areas of regulatory reform. For such purposes, the Department should draw upon its "Program Direction" funds or the Secretary's funds instead of R&D program funds.

Three Mile Island R&D

The objectives of the Three Mile Island (TMI) activity are to develop the technology that will improve the capability of civilian nuclear powerplants to safely recover from accidents and to conduct relevant R&D that will substantially enhance powerplant safety and operation. There are two primary efforts within this element: (1) TMI waste immobilization and reactor evaluation, and (2) data acquisition.

The data and information acquired will provide an improved basis for evaluating licensing criteria, analyzing causes and consequences of accidents, improving reliability of design and operation

of LWR's and understanding how to deal with accident-generated abnormal reactor wastes.

In fiscal year 1987, the Committee recommends $12,000,000 for continuation of R&D work in connection with cleaning-up the Three Mile Island nuclear plant. The DOE is to continue examination of the damaged TMI-2 reactor core at the Idaho National Engineering Laboratory (INEL) and other laboratories, as well a transferring the information obtained to industry. The information consists of data that is expected to be useful in determining future licensing criteria based on full-scale accident results as they apply to fuel rod damage, core degradation, fission product release, deposition and recriticality.

(2) Advanced Converter Reactor Technology

The Committee's recommendations add $46,600,000 to the Department's request for a total authorization of $136,000,000 to provide: (1) $22,000,000 for Advanced Light Water Reactor Technology; (2) $34,000,000 for the Advanced High Temperature Gas-Cooled Reactor; and (3) $90,000,000 for the Liquid Metal Converter Reactor.

Advanced light water reactor technology

The Committee includes two basic program areas in the Advanced Light Water Reactor category. The first is the continuation of the design certification programs associated with the advanced pressurized and boiling water reactors in the 1,000 megawatt-electric size range. The second basic program area includes conceptual design activities associated with passively safe, mid-sized pressurized and boiling water reactor system in the range of 660 megawatt-electric. The Committee's recommendations redirect $4,000,000 from Improved LWR technology for the purpose of continuing with the design certification of advanced large pressurized and boiling water reactors on a fast track schedule to assure early resolution of safety and licensing issues.

Advanced high temperature gas-cooled reactor

The fiscal year 1987 budget request of $5,300,000 for the Advanced High Temperature Gas-Cooled Reactor was viewed by the Committee as a de facto program termination. The Committee has championed this program since its inception and views it as an essential element in restoring the nuclear option by offering an ultra-safe reactor in which the public can have increased confidence and which could be deployed in the 1990's. Accordingly, the Committee authorizes a total increase of $28,700,000 for a total of $34,000,000.

The fiscal year 1987 High Temperature Gas-Cooled Reactor Program is to continue with the development of the 150 megawatt-electric side-by-side, prismatic-core modular reactor. The activities in fiscal year 1987 are to include the completion of the work with the Nuclear Regulatory Commission to obtain a "licensability statement." The work will also include: completion of the preliminary design of the Nuclear Steam Supply System (NSSS), completion of the fabrication of low-enriched fuel ready for test, completion of "balance of plant" preliminary design, finalization studies

on fabrication and construction techniques and tooling, continuation of materials development, completion of the preliminary design of the multi-module plant control system, initiation of fuel capsule tests, and completion of the graphite failure report. The DOE should integrate these activities with related work in the private sector.

Within the $34,000,000, $6,000,000 is provided for technology development related to HTGR fuel performance, fission product behavior, graphite studies, and international cooperation in the above areas. Emphasis is to be on: (a) validating the capability of HTGR coated fuel particles for retaining fission products under postulated accident conditions (e.g., complete loss of coolant flow and coolant pressure); (b) validating fission product retention behavior within the reactor system during postulated accident conditions (e.g., rapid depressurization of reactor system); (c) validating the limited oxidation of graphite which occurs under postulated extreme accident conditions (e.g., air ingress), and the associated graphite strength characteristics; (d) expanding international cooperation in the above areas to facilitate a broader, more cost-effective program.

Liquid metal converter reactor

In the fiscal year 1987 budget request, the Department of Energy has included the Liquid Metal Converter Reactor within the Advanced Reactor Research and Development activity. The Advanced Reactor R&D program is comprised of six program elements. These include: (1) passive safety; (2) communications, control, and operations; (3) long life core; (4) metal fuels; (5) standardization, modularity and shop fabrication; (6) components and reliability. The Liquid Metal Converter Reactor program activities are spread among these six subactivities. The principal effort in fiscal year 1987 is the completion of the design assessment for the two innovative liquid metal reactor concepts proposed by the General Electric Company (PRISM) and Rockwell International (SAFR).

The Department lists as one of its goals the identification of specific data and test needs to guide experimental research and development activities and confirmation test programs related to these two reactor design concepts. The Department is scheduled to make a selection between the two concepts in fiscal year 1987.

Additional funds to support the Liquid Metal Converter Reactor program in fiscal year 1987 are included within the Department's fiscal year 1987 Facilities program. Funds within this line are specifically directed to support Liquid Metal Converter Reactor activities at test facilities located in Hanford, Washington; Idaho; Oak Ridge, Tennessee; and Santa Susana, California. Laboratories involved in this support are: (1) the Hanford Engineering Development Laboratory; (2) the Argonne National Laboratory—West Facilities in Idaho; (3) the Oak Ridge National Laboratory; and (4) the Energy Technology Engineering Center (ETEC). The metal fuels program incorporates the activities related to the Integrated Fast Reactor (IFR) research and development activity performed by the Argonne National Laboratory. Fiscal year 1987 activities in this area include the demonstration of metal fuel performance characteristics and the evaluation of the safety margins associated with the Uranium/Plutonium/Zirconium fuel.

The Department of Energy's fiscal year 1987 budget request for the Liquid Metal Converter Program totals $76,100,000 which represents an increase of $11,200,000 above the fiscal year 1986 appropriation of $64,900,000. Of this amount, $51,200,000 is to be allocated for facility operations in connection with the Liquid Metal Converter Reactor Program.

The Committee's recommendations increase the Liquid Metal Converter Reactor authorization level in fiscal year 1987 by $15,800,000. This increase is to be obtained through a redirection of $1,900,000 from Liquid Metal Reactor-related test programs at the Energy Technology Engineering Center (ETEC) in Santa Susana, California, and a funding increase of $13,900,000 in the Liquid Metal Converter Reactor activity. The Committee finds that $1,900,000 of engineering test activities at ETEC can be deferred until the innovative liquid metal reactor designs are further delineated and a design selection is made. The increase is to be distributed as follows. The Integrated Fast Reactor (IFR) Program is to receive an increase of $6,000,000 above the Department's fiscal year 1987 budget request for this activity to provide a total of $12,000,000 in support for this Argonne National Laboratory program. These additional funds for the IFR are to be used to continue the basic research and development associated with the new IFR pyroprocessing technology. The balance of the increased allocation, amounting to $9,800,000, is to be used to supplement the Department of Energy's proposed funding in fiscal year 1987 for the innovative LMR reactor design activities associated with the SAFR and PRISM programs. The Committee seeks to ensure that a design selection can be made in fiscal year 1987 by assuring that funding levels are adequate to support contractor work related to these design activities.

(3) Advanced Breeder Reactor Technology

The Advanced Breeder Reactor Technology program has also been incorporated into the Department's fiscal year 1987 budget request under two program categories: (1) Advanced Reactor Research and Development and (2) Facilities. The Advanced Breeder Reactor Technology program comprises five subcategories. These include Breeder Component Technology, Fuel Performance and Supply, Reactor Core Technology, Test Facilities and Nuclear Fuel Cycle. The Department's fiscal year 1987 budget request for these activities amounts to $79,800,000, nearly 50 percent below the fiscal year 1986 appropriation of $152,058,000.

The Committee's recommendations add $12,300,000 to the Department's request for a total authorization of $92,100,000 to provide: (1) $7,500,000 for Fuel Performance and Supply; (2) $6,800,000 for Reactor Core Technology; (3) $71,000,000 for Test Facilities; and (4) $6,800,000 for Nuclear Fuel Cycle.

Fuel performance and supply

The Committee's recommendations for Fuel Performance and Supply support the Department's request of $7,000,000 for operating expenses and $500,000 for capital equipment for a total authorization of $7,500,000.

Reactor core technology

The Committee's recommendations for Reactor Core Technology support the Department's request of $5,000,000 for operating expenses and $1,800,000 for capital equipment for a total authorization of $6,800,000.

Test facilities

The Committee's recommendations add $7,000,000 to the Department's request for the Hanford Engineering Development Laboratory (HEDL) Advanced Reactor Program for a total of $77,600,000. This funding is critically important to sustain a meaningful technology program to complement operation of the Fast Flux Test Facility (FFTF). Notwithstanding the $7,000,000 addition, however, the Comittee believes that an overall $9,000,000 increase for HEDL would be appropriate to optimize the Federal investment. A full $9,000,000 increase would insure normal FFTF operation, maintain the fuel supply on schedule, and preserve a technology component for the advanced reactor program.

The Committee strongly supports continued long-term operation of the DOE test facilities, particularly the FFTF. In addition to the beneficial research programs which maintain an American presence in development of the breeder reactor, the FFTF and similar facilities are crucial for testing and development of the evolving space nuclear reactor. A special report prepared by the Subcommittee on Energy Research and Production concluded last December that: "If these facilities were shut-down, properly paced development of these space reactor concepts would be jeopardized." Accordingly, DOE should commit themselves to long-term operation of key test facilities such as the FFTF because they are necessary test-beds for the space reactor development program.

In addition, the Committee recognizes the need for long-term operation of the EBR-11. Tests conducted in April 1986 of the Integral Fast Reactor technology demonstrated that natural circulation and advanced design features of the Integral Fast Reactor core were sufficient to control reactivity even with the loss of electrical power and coolant pumping. The Committee recognizes the importance of continued research into such inherently safe liquid metal reactor designs.

Nuclear fuel cycle

The fiscal year 1987 Nuclear Fuel Cycle Program is for the continuation of research and development work in advanced robotics for separation systems. The work is to include techniques such as force-reflecting manipulators that provide kinesthetic information required to regulate variable forces to perform a wider range of robotic work tasks. This Program is a component of an international effort to develop remote systems which eliminate human contact with highly radioactive materials, and the Committee's recommendations add $5,300,000 for a total of $6,800,000 to provide for the continuation of research and development work on advanced rebotic systems. The Committee finds that these systems are essential to further reducing operator exposure to radioactive materials in the nuclear industry.

(4) Water Cooled Breeder Reactor Technology

In fiscal year 1987, the Department of Energy proposes to complete activities related to the Water Cooled Breeder Reactor Technology program. This includes completion of the core evaluation tasks and defueling activities related to the shipment and storage of breeder core materials at the Idaho site. Final activities in this program would also include preparation of the final documentation describing the core evaluation activities and the results thereof.

The Committee recommends deferring all expenses related to the Water Cooled Breeder Reactor Technology program in fiscal year 1987. This involves a reduction of $13,800,000 requested by the Department of Energy in fiscal year 1987 for this activity. The Committee finds that activities related to the Water Cooled Breeder Reactor program are not relevant for the direction of the Department's present Civilian Reactor Development program. Activities related to core evaluation can be deferred until such time as market and user needs justify the expense required to complete these activities. Defueling activities, which primarily involve transporting material already located at the Idaho site into disposal areas, was to have been completed, according to Department documents, at the end of fiscal year 1984. The Committee recommends that the additional $3,600,000 requested for fiscal year 1987 for defueling activities should be obtained by other means, perhaps from other Naval Reactor development funds. The Committee repeats its view that incurring additional expenses for this activity are not justified in these times of declining Nuclear Fission R&D budgets.

(5) Civilian Reactor Development Program Support

The Civilian Reactor Development Program Support activity in fiscal year 1987 provides funds to support management and administrative activities associated with the Civilian Reactor Development Program, including support for reactor research development, safeguards and security, and program direction. Also included in this activity are funds to assist universities in developing and sustaining active programs in nuclear engineering related to the mainstream programs of the Department of Energy's fiscal year 1987 program.

The Committee's recommendations for this program provide an additional $2,500,000, for a total funding of $20,300,000. These recommendations include an increase of $3,000,000 for university engineering research to support activities in nuclear fission research at universities to maintain viable nuclear engineering education programs in support of U.S. nuclear fission R&D objectives. In addition, and in view of the overall decrease of $500,000 in fiscal year 1987 authorization support for the Civilian Reactor Development Program, management and administrative activities.

(6) Advanced Nuclear Systems

The Advanced Nuclear Systems program includes activities related to nuclear radioisotope power sources. These power sources are utilized to meet civilian and military applications such as the two NASA spacecraft launches originally scheduled for the Spring of

1986 (Ulysses and Galileo). Program actvities for fiscal year 1987 include continued demonstration system life testing for modular radioisotope thermoelectric generators (RTG's), beginning preliminary design for the Marine Mark II RTG's and continued long-term testing of terrestial RGT engineering demonstration units.

Prior to the Challenger accident, the next flights of the shuttle were to carry the Galileo and the Ulysses spacecraft. These two spacecraft were to be powered by RGT's. As a result of the accident, these two flights have been postponed. The Subcommittee on Energy Research and Production held hearings jointly with the Space Science and Applications Subcommittee in order to investigate the status of safety evaluations of the RTG systems onboard the shuttle. These hearings suggested that additional safety investigations related to the incorportion of RTG power sources would serve to substantiate safety features of the RTG power sources.

The Committee recommendations add $2,500,000 to the Department's request for a total authorization of $28,900,000 to provide: (1) $27,600,000 for Space and Special Applications; and (2) $1,300,000 for Program Direction.

(7) Other Fission R&D Activities

According to the Department of Energy's Fiscal Year 1987 Budget Request, the Space and Defense Power System activity is an integrated set of R&D elements aimed at developing nuclear power sources to support emerging Department of Defense requirements for a variety of terrestial and space missions, including the Strategic Defense Initiative. This program element includes the SP-100 project, a 300 kilowatt-electric class space reactor power system project. Also, this activity includes a significant initiative in multi-megawatt (MMW) space reactor technology that will involve the identification and evaluation of very high performance concepts incorporating such crticial technologies in support of Strategic Defense Initiative space prime power requirements.

Other activities in this area include the Small Nuclear Power Source demonstration project that involves the development of a 15 kilowatt-electric terrestial reactor power system as an alternate power supply to update the Distant Early Warning line across northern Canada, and the Dynamic Isotope Power System that involves the design and subsequent development and testing of a rugged radioisotope heat source with high efficiency dynamic energy conversion to meet military space requirements.

The Committee recommends an overall decrease of $5,000,000 to the Department's request for a total authorization of $51,420,000 to provide: (1) $22,000,000 for Space Reactor Technology (SP-100); (2) $1,800,000 for the North Warning Power Plant; (3) $10,920,000 for the Dynamic Isotope Power System; (4) $13,150,000 for the Multi-megawatt (MMW) Space Power System; (5) $3,000,000 for the MMW Terrestrial Power Plant; and (6) $550,000 for Program Direction.

The decrease of $5,000,000 is to include a $4,000,000 reduction in the MMW space reactor development program, and a $1,000,000 decrease in the Dynamic Isotope Power System activity in fiscal year 1987. The Committee believes these funding reductions are appro-

priate until such time as confirmed funding commitments and needs identification from the Strategic Defense Initiative Organization and from other operating elements of the Air Force Space Directorate have been sufficiently established in terms of operational requirements.

The Committee authorizes $3.0 million in FY 1987 for the development of a Multimegawatt Terrestrial Power Plant (MTP) for United States Air Force (USAF) Installations. This authorization is intended to complement funding from the USAF.

The Committee recognizes the importance of developing a 10 Megawatt nuclear reactor power plant to provide U.S. military bases with a secure, reliable, and economic power source. The Committee strongly endorses the MTP project and encourages the Department of Energy and its laboratories to continue its partnership with the Air Force in implementing this initiative.

b. Remedial Action and Waste Technology

Two Remedial Action and Waste Technology Program activities are under the Committee's sole jurisdiction: Waste Treatment, and Civilian Byproducts and Beneficial Uses. The Committee's recommendations for fiscal year 1987 add $3,000,000 for Waste Treatment (for a total authorization of $3,000,000 in fiscal year 1987), and $5,000,000 for Civilian Byproducts and Beneficial Uses (for a total authorization of $5,000,000).

Waste treatment

The Committee's recommendations add $3,000,000 to the Department's request for Waste Treatment for a total authorization of $3,000,000 in order to continue the program.

The goal of the Waste Treatment program is to develop and demonstrate technologies for the treatment and immobilization of nuclear fuel cycle radioactive wastes in a form acceptable for transportation, storage and ultimate disposal in a licensed repository. This program involves identifying and characterizing the types of waste requiring treatment; understanding the regulatory requirements; developing the technologies to treat wastes; testing the developed technology to determine its reliability, efficiency, and adequacy in meeting environmental, safety, and health protection requirements; and providing a technical resource for other programs in designing, contructing, and operating treatment systems for specific wastes of interest to the Department.

The Department has invested roughly $16,000,000 to develop a waste treatment technological capability at the Pacific Northwest Laboratory. It has sought and encouraged international financial and technical participation in this program, and the Federal Republic of Germany and Japan are presently participating. Termination at this time as recommended by the Administration is not a wise decision—either in a national programmatic sense or from an international perspective. The Department cannot expect to increase foreign participation in research and development while at the same time demonstrating its unpredictability and unreliability in programs where we already have such international participation.

The waste solidification work under this program has proven its value at Savannah River and West Valley, and there are additional data development requirements associated with solidification of transuranic and high-level wastes and spent fuel consolidation that this program could address in a cost-effective manner. In view of the obvious problems with terminating this program, the Committee directs the Department to prepare a report on how it plans to resolve waste solidification process issues beyond fiscal year 1987, if this facility and the technology base are abandoned. This report should be submitted to the Committee by September 1, 1986.

Civilian byproducts and beneficial uses

The Committee's recommendations add $5,000,000 to the Department's request for a total authorization of $5,000,000 in order to continue the Food Irradiation program in the Civilian Byproducts and Beneficial Uses activity at the fiscal year 1986 level.

Last year, the Committee initiated the Civilian Byproducts and Beneficial Uses activity within the Nuclear Waste Technology program. This major initiative emphasized food irradiation and directed the Department of Energy to establish and lead, in close cooperation with the Department of Agriculture, a civilian intergrated byproducts program under the Assistant Secretary for Nuclear Energy. This program includes all aspects of byproduct work including application technology development and demonstration, and technology for the supply of byproducts with the emphasis on food irradiation and other food-related applications. A key objective of the program is the demonstration of selected applications, particularly support for food irradiators. Support of irradiators is to be aimed at maximizing technology transfer to the private sector.

The Committee is pleased that the initiative has gone forward and provides an additional $5,000,000 to continue the activity in fiscal year 1987, and to encourage private participation in the development of food irradiators.

c. Civilian Radioactive Waste R&D

The objective of the Civilian Radioactive Waste Research and Development program is to provide for spent nuclear fuel storage research and development, and research, development and investigation of alternative means for the permanent disposal of nuclear waste. Program activities include the development of licensing data for the dry storage of spent nuclear fuel and for rod consolidation; and technical assistance to non-nuclear weapon states in the fields of spent nuclear fuel storage and disposal.

The Committee's recommendations add $9,600,000 to the Department's request for Civilian Radioactive Waste R&D for a total authorization of $16,100,000 to provide: (1) $6,300,000 for Spent Fuel Storage Development; (2) $9,600,000 for Alternative Disposal Concepts; and (3) $200,000 for Program Direction.

The increase of $9,600,000, above the zero-funding level requested by the Department for Alternative Disposal Concepts is for subseabed disposal to provide for the continuation of research and development on the feasibility of this disposal concept. In the Nuclear Waste Policy Act of 1982, the Committee directed the DOE to con-

tinue and R&D program associated with alternative nuclear waste disposal concepts. The international sub-seabed program is the only potential alternative disposal concept to the geologic disposal of high-level radioactive wastes and should be continued through demonstration of the feasibility of the concept. Continued U.S. participation in this international program will also help ensure that this disposal option is thoroughly evaluated prior to its utilization by any other nation.

The Committee recommends that funding for research on Subseabed Disposal of radioactive waste be maintained at $9.6 million annually through fiscal year 1991. This funding level would adequately support the scientific research needed to establish concept feasibility.

DETAILED SUMMARY

Details of the Committee's recommendations, current year estimates, and the budget request for Nuclear Fission R&D are shown on the following tables:

NUCLEAR FISSION R&D—FISCAL YEAR 1987 BUDGET AUTHORIZATION

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
NUCLEAR ENERGY R&D				
Improved light water reactor technology:				
Improved LWR Development: Operation expenses	12,509	11,000	−5,000	6,000
Three Mile Island R&D: Operating expenses	31,079	12,000	0	12,000
Subtotal, improved light water reactor technology	43,588	23,000	−5,000	18,000
Advanced converter reactor technology:				
Advanced light water reactor (LWR) technology: Operating expenses	4,570	18,000	+4,000	22,000
Advanced high temperature gas-cooled reactor (HTGR):				
Operating expenses	29,588	5,100	+27,900	33,000
Capital equipment	962	200	+800	1,000
Subtotal, advanced HTGR	30,550	5,300	+28,700	34,000
Liquid metal converter reactor:				
Operating expenses	63,746	74,900	+13,900	88,800
Capital equipment	192	200	0	200
Construction:				
86–N–101, modifications to reactors, various locations	962	0	0	0
87–N–101, modifications to reactors, various locations	0	1,000	0	1,000
Subtotal, construction	962	1,000	0	1,000
Subtotal, liquid metal converter reactor	64,900	76,100	+13,900	90,000
Subtotal, advanced converter reactor technology	100,020	99,400	+46,600	146,000
Advanced breeder reactor technology:				
Breeder component development: Operating expenses	6,447	0	0	0

NUCLEAR FISSION R&D—FISCAL YEAR 1987 BUDGET AUTHORIZATION—Continued

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
Fuel performance and supply:				
Operating expenses	21,265	7,000	0	7,000
Capital equipment	1,924	500	0	500
Subtotal, fuel performance and supply	23,189	7,500	0	7,500
Reactor core technology:				
Operating expenses	4,715	5,000	0	5,000
Capital equipment	2,232	1,800	0	1,800
Subtotal, breeder core technology	6,947	6,800	0	6,800
Test facilities:				
Operating expenses	93,556	59,200	+7,000	66,200
Capital equipment	4,311	2,600	0	2,600
Construction:				
86–N–102, general plant projects, various locations	1,732	0	0	0
87–N–102, general plant projects, various locations	0	2,200	0	2,200
Subtotal, construction	1,732	2,200	0	2,200
Subtotal, test facilities	99,599	64,000	+7,000	71,000
Nuclear fuel cycle: Operating expenses	15,876	1,500	−5,300	6,800
Subtotal, advanced breeder reactor technology	152,058	79,800	+12,300	92,100
Water cooled breeder reactor technology:				
Defueling: Operating expenses	4,907	3,600	−3,600	0
Core evaluation: Operating expenses	14,048	10,200	−10,200	0
Subtotal, water cooled breeder reactor technology	18,955	13,800	−13,800	0
Civilian reactor development program support:				
University engineering research support: Operating expenses	0	0	+3,000	3,000
Reactor development research support: Operating expenses	2,526	3,500	0	3,500
Safeguards and security:				
Operating expenses	4,883	6,000	0	6,000
Construction: 85–N–602, ANL–West physical security upgrades, INEL	866	600	0	600
Subtotal, safeguards and security	5,749	6,600	0	6,600
Reduced enrichment research and test reactor (RERTR): Operating expenses	5,003	0	0	0
Program direction: Operating expenses	6,892	7,700	−500	7,200
Subtotal, civilian reactor development program support	20,170	17,800	+2,500	20,300
Advanced nuclear systems:				
Space and special applications:				
Operating expenses	19,682	25,100	+2,500	27,600
Capital equipment	1,636	3,000	0	3,000
Subtotal, space and special applications	21,318	28,100	+2,500	30,600
Program direction: Operation expenses	813	1,300	0	1,300
Subtotal, advanced nuclear systems	22,131	29,400	+2,500	31,900
Other fission R&D activities:				
Space reactor technology (SP–100):				
Operating expenses	14,057	22,000	0	22,000

NUCLEAR FISSION R&D—FISCAL YEAR 1987 BUDGET AUTHORIZATION—Continued

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
Capital equipment	0	3,000	0	3,000
Construction 89-N-105, SP-100 ground eng. system test facility mod, Hanford Eng. Dev. Lab	1,924	5,000	0	5,000
Subtotal, space reactor technology (SP-100)	15,981	30,000	0	30,000
North Warning Power Plant:				
Operating expenses	2,406	1,800	0	1,800
Capital equipment	0	200	0	200
Subtotal, North Warning Power Plant	2,406	2,000	0	2,000
Dynamic isotope power system (DIPS):				
Operating expenses	0	11,920	−1,000	10,920
Capital equipment	0	1,080	0	1,080
Subtotal, DIPS	0	13,000	−1,000	12,000
Multimegawatt (MMW) space power system:				
Operating expenses	0	17,150	−4,000	13,150
Capital equipment	0	2,000	0	2,000
Subtotal, MMW space power system	0	19,150	−4,000	15,150
MMW Terrestrial Power Plant: Operating expenses	0	3,000	0	3,000
Program direction: Operating expenses	375	550	0	550
Subtotal, defense nuclear energy	18,762	67,700	−5,000	62,700
Subtotal, nuclear energy R&D	375,684	330,900	+40,100	371,000
(Operating expenses)	(357,019)	(307,520)	(+39,300)	(346,820)
(Plant and capital equipment)	(18,665)	(23,380)	(+800)	(24,180)
Remedial action and waste technology:				
Waste treatment:				
Operating expenses	5,773	0	+3,000	3,000
Capital equipment	433	0	0	0
Subtotal, waste treatment	6,206	0	+3,000	3,000
Civilian byproducts and beneficial uses: Operating expenses	4,811	0	+5,000	5,000
Subtotal, remedial action and waste technology	11,017	0	+8,000	8,000
(Operating expenses)	(10,584)	(0)	(+8,000)	(8,000)
(Plant and capital equipment)	(433)	(0)	(0)	(0)
Civilian radioactive waste R&D:				
Spent fuel storage development:				
Operating expenses	7,496	6,300	0	6,300
Capital equipment	1,058	0	0	0
Subtotal, spent fuel storage development	8,554	6,300	0	6,300
Alternative disposal concepts:				
Operating expenses	5,292	0	+9,600	9,600
Capital equipment	1,915	0	0	0
Subtotal, alternative disposal concepts	7,207	0	+9,600	9,600
Program direction: Operating expenses	303	200	0	200
Subtotal, civilian radioactive waste R&D	16,064	6,500	+9,600	16,100
(Operating expenses)	(13,091)	(6,500)	(+9,600)	(16,100)

NUCLEAR FISSION R&D—FISCAL YEAR 1987 BUDGET AUTHORIZATION—Continued

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
(Plant and capital equipment)	(2,973)	(0)	(0)	(0)
Total, nuclear fission R&D	402,765	337,400	+57,700	395,100
(Operating expenses)	(380,694)	(314,020)	(+56,900)	(370,920)
(Plant and capital equipment)	(22,071)	(23,380)	(+800)	(24,180)

3. Magentic Fusion Energy

The Magentic Fusion Energy program is a national research effort to develop a major new energy source for this country in the next century. Fusion energy offers several attractive features, including intrinsic safety and minimum environmental problems. Fusion would utilize a vast fuel reserve that is inexpensive, readily available, and could have multiple uses such as generation of electricity, production of fuel for nuclear reactors, and high-grade heat for industrial use. Realization of these potential benefits at an economically attractive price requires progress in a number of areas of physics and technology development. The goal of the Department's Magnetic Fusion Energy program is to develop the scientific and technological base required for an attractive fusion energy option. This includes demonstrating the technical viability and basic engineering feasibility of fusion to the point where we can predict economic and environmental performance of reactor designs.

Since decades are required to develop significant new energy sources in order to provide for a flexible energy supply system, it is important to maintain progress on potential long-term solutions, such as fusion. Thus, the mission of the fusion program continues to be important even though the urgency to develop new sources of energy has decreased with falling oil prices.

In response to increasingly stringent budget pressure, the Magnetic Fusion Energy program has begun terminating research on mirror confinement systems and focusing on generic toroidal confinement approaches, with the specific initiative of a toroidal ignition experiment to develop and verify the scientific data base associated with burning plasmas.

Significant program flexibility is to be maintained by retaining, under the aegis of toroidal confinement, research on innovative advanced toroidal concepts. The projected budget levels will not support the construction and operation of the larger follow-on fusion research facilities that will be necessary to develop and demonstrate engineering feasibility. The DOE is to pursue the use of cost-shared international cooperative arrangements for this phase of technology development.

COMMITTEE VIEWS

The Committee has three major concerns about the funding and direction of the Magnetic Fusion Energy program. First, the Committee believes that the present funding level is the minimum required to sustain a focused toroidal program while providing for aggressive research on alternative concepts so that tomorrow's reactors will be simple and economic. Secondly, the Committee retains its concern about programmatic foci for the fusion program. These include the ignition project and the preservation of the mirror option. The Committee is concerned by the decision to mothball the newly-completed MFTF-B at Lawrence Livermore National Laboratory before obtaining any experimental results from it. Continuation of MFTF-B should be a high priority if additional funds can be made available in the appropriations process.

Finally, the Committee recommends that DOE plan flexibly for international cooperation while protecting a strong domestic program. In this regard, the Committee believes that the Ignition Project is critical to the success of international cooperation independent of the approach adopted. However, the Committee recommends that the Department give the Ignition Project equal consideration as a potential candidate for cooperation with the Soviets as the more ambitious follow-on fusion engineering device or test reactor. The Committee is concerned that issues such as technology transfer might lessen the prospects for a joint U.S./U.S.S.R/JET/Japanese fusion engineering project. The Committee notes that the Ignition Project, which is to be focused on studying of burning plasma, would provide many of the advantages of international cooperation while it appears that it might also obtain widespread support within the Administration and the Congress. In that way the U.S. would be able to go forward with fusion cooperation "in the spirit of Geneva" while still allowing for follow-on activity with the Japanese and our European allies on the Fusion Test Reactor (FTR).

Siting of an ignition project

The Committee believes that the main objective of fusion research must be the commercialization of fusion power at the earliest realistic date. It is not unrealistic to assume that a magnetic fusion power demonstration facility can be on the line early in the next century with a focused program, and without dramatic increases in present funding levels.

The Committee recommends that any new constructed fusion device which involves the actural burning of deuterium and tritium above minimal trace quantities be located at a suitable site. Such site should provide the backup facilities required for any activity producing large quanities of high energy neutrons and radioactive materials and meet the DOE's environmental criteria for such a project.

The Committee recommends that, independent of design, the next machine should at least include a burning core; that is, be capable of a sustantine deuterium/tritium burn. It is not, however, necessary that the buring core be designed to be integrated with any particular device for absorbing neutrons, removing heat, or

providing shielding. In addition, no attempt should be made to breed tritium in such a machine or shielding device.

The Committee recognizes that fusion R&D must lead toward practical, commerical fusion power. For this reason, any commercial fusion device must be fabricated so that it can be readily removed from the utility where it is operated after it has completed its useful life. No device fabrication should be approved by DOE unless it constitutes either a basic research experiment or is consistent with the concept of moving toward commerical fusion production.

COMMITTEE ACTIONS

The Committee's recommendations add $5,000,000 to Planning and Projects operating expenses, for a total authorization of $9,780,000, to support an increase in the pace of the "Low-Cost Ignition Device." The Committee requests that the Department of Energy submit a complete program plan for the Low-Cost Ignition Device by November 1, 1986. The program plan is to set forth specific objectives, work tasks, schedules, associated costs, a "siting plan", specifics of international cooperation and a description of how the program is to be managed. The Department of Energy Office of Magnetic Fusion Energy is directed to work out arrangements for use of its computer network by the Nuclear Engineering Department of the University of Missouri in support of their program's magnetic cusp research activities.

DETAILED SUMMARY

Details of the Committee's recommendations, current year estimates and the budget request for Magnetic Fusion Energy are shown on the following tables:

MAGNETIC FUSION ENERGY—FISCAL YEAR 1987 BUDGET AUTHORIZATION

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
Applied plasma physics:				
Operating expenses	69,692	70,700	0	70,700
Capital equipment	5,619	4,500	0	4,500
Subtotal, applied plasma physics	75,311	75,200	0	75,200
Confinement systems:				
Operating expenses	18,650	177,500		177,500
Capital equipment	14,529	7,100	0	7,100
Subtotal, confinement systems	203,179	184,600	0	184,600
Development and technology:				
Operating expenses	57,059	50,510	0	50,150
Capital equipment	4,330	1,890	0	1,890
Subtotal, development and technology	61.389	52,400	0	52,400
Planning and projects:				
Operating expenses	5,528	4,780	+5,000	9,780
Capital equipment	3,801	3,802	0	3,820

MAGNETIC FUSION ENERGY—FISCAL YEAR 1987 BUDGET AUTHORIZATION—Continued

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
Construction	12,853	8,200	0	8,200
Subtotal, planning and projects	21,982	16,800	+5,000	21,800
Program direction: Operating expenses	3,608	4,000	0	4,000
Total, magnetic fusion energy	365,469	333,000	+5,000	338,000
(Operating expenses)	324,537	307,490	+5,000	312,490
(Plant and capital equipment)	40,932	25,510	0	25,510

4. Inertial Confinement Fusion

Inertial Confinement Fusion (ICF) for civilian applications is aimed at generating electricity from the energy liberated by focusing high energy laser, or ion beams on deuterium-tritium targets. Much of the physics data obtained in the weapons simulation program is applicable to this research base.

COMMITTEE ACTION

In fiscal year 1987, the Committee directs the Department of Energy to investigate the civilian applications potential of inertial confinement fusion in view of the recent terrestrial progress achieved in the ICF laser program as well as in complementary underground tests. The Committee recognizes that the DOE Defense Programs budget includes no funding for such activity in the fiscal year 1987 request. The Committee also understands that the National Academy of Sciences report is supportive of retaining a civilian applications thrust in the ICF program.

The Committee's recommendations add $3,000,000 to provide for a comprehensive review of the advancements made in inertial confinement fusion, and for systems design studies of reactor concepts which might lead to the practical application of this technology for the economical production of electrical power. The Committee expects that the Fusion Engineering Design Center (FEDC) and the Lawrence Livermore and Sandia (Albuquerque) National Laboratories will be the major participants in these efforts.

INERTIAL CONFINEMENT FUSION—FISCAL YEAR 1987 BUDGET AUTHORIZATION

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
Operating expenses	0	0	+3,000	3,000
Subtotal, inertial confinement fusion	0	0	+3,000	3,000

5. Supporting Research and Technical Analysis

Seven programs comprise the Office of Energy Research's portion of the Supporting Research and Technical Analysis category of the agency's budget: (1) Basic Energy Sciences (Materials Sciences, Chemical Sciences, Nuclear Sciences, Applied Mathematical Sciences, Engineering and Geosciences, Advanced Energy Projects, and Biological Energy Research); (2) Energy Research Analysis; (3) Advisory and Oversight Program Direction; (4) University Research Support; (5) University Research Instrumentation; (6) Multiprogram Energy Laboratories—Facilities Support; and (7) Policy and Management. The Department's fiscal year 1987 request for Supporting Research and Technical Analysis totals $524,535,000, an increase of $29,035,000 from the fiscal year 1986 appropriation of $495,500,000.

COMMITTEE VIEWS

Basic energy sciences

Planning.—In last year's authorization reports (House Report 99–54 and House Report 99–55, Part I), the Committee directed "the Department, in conjunction with the appropriate scientific advisory groups, to develop and submit by December 1, 1985, a long-range plan for overall research priorities, facilities construction and operation, and facility-based research" for the Basic Energy Sciences program. The Department has yet to comply with this request. Accordingly, the Department is urged to submit this report prior to the submission of its fiscal year 1988 budget request.

Basic Energy Sciences Advisory Committee.—The Committee agrees with the December 1985 recommendation of the Energy Research Advisory Board (ERAB) that "[a] Basic Energy Sciences Advisory Committee should be established to make recommendations with respect to scientific opportunities and priorities as well as future facilities." The Department is directed to establish such an advisory committee as expediently as possible.

Basic Energy Sciences Facilities.—The Committee also agrees with the December 1985 ERAB recommendation that "[a] separate budget category for facilities construction and operation should be established." Beginning with the fiscal year 1988, and subsequent budget submissions, the Department is directed to establish a budget category.

Continental Scientific Drilling Program.—In last year's authorization reports (House Report 99–54 and House Report 98–55, Part 1), the Committee directed the Department of Energy, the National Science Foundation and the U.S. Geological Survey to "prepare an implementation plan for submission to the Congress prior September 30, 1985." The Committee has been informed that the plan has been delayed. The Committee reiterates its desire that the plan be completed and submitted to Congress as soon as possible.

University research support

University Reactor Fuel Assistance.—The Nuclear Regulatory Commission (NRC) has published recently its final rule limiting the use of highly enriched uranium (HEU) in domestically licensed re-

search and test reactors. The new amendments "generally would require that new licensed non-power reactors use low enriched uranium (LEU) fuel, and, contingent on Federal Government funding for conversion-related costs, that licensees of existing non-power reactors replace HEU fuel with LEU fuel acceptable to the Commission." The NRC notes that "[i]t is anticipated that the funding necessary for conversion activities for both university and other licensees could be provided through DOE or other Federal agency." The Department is directed to provide such funds as may be required in order to maintain a viable university research reactor program.

COMMITTEE ACTIONS

a. Basic Energy Sciences

Material sciences

The Committee supports the Department's request for Materials Sciences of $196,391,000, including $156,931,000 for operating expenses, $15,500,000 for capital equipment, and $23,960,000 for construction.

The total for operating expenses of $156,931,000 includes $2,000,000 for research and development on a 6 GeV Synchrotron Radiation Source at Argonne National Laboratory, $2,000,000 for research and development on an Advanced Steady State Research Reactor at Oak Ridge National Laboratory, $1,300,000 for operation of the Los Alamos Neutron Scattering Center (LANSCE) at Los Alamos National Laboratory, and $1,500,000 for research and development on the 1-2 GeV Synchrotron Light Source at the Lawrence Berkeley Laboratory.

The total for capital equipment of $15,500,000 includes $1,000,000 for research and development of a 6 GeV Synchrotron Radiation Source at Argonne National Laboratory, $500,000 for research and development on an Advanced Steady State Research Reactor at Oak Ridge National Laboratory, and $500,000 for research and development on the 1-2 GeV Synchrotron Radiation Source at Lawrence Berkeley Laboratory.

The total for construction of $23,960,000 includes $5,000,000 for Project 87-R-403, the Neutron Scattering Experimental Hall at Los Alamos National Laboratory, and $1,500,000 for Project 87-R-406, the 1-2 GeV Synchrotron Radiation Source at Lawrence Berkeley Laboratory.

Chemical sciences

The Committee's recommendations for Chemical Sciences add $5,000,000 to the Department's request for operating expenses to fund initiatives recommended in the National Research Council's 1985 report, "Opportunities in Chemistry" for a total authorization of $106,303,000, including $91,419,000 for operating expenses, $9,555,000 for capital equipment, and $5,420,000 for construction.

Nuclear sciences

The Committee supports the Department's request of $49,993,000 for Nuclear Sciences, including $46,913,000 for operating expenses, $2,930,000 for capital equipment, and $150,000 for construction.

Applied mathematical sciences

The Committee's recommendations for Applied Mathematical Sciences add $11,479,000 to the Department's request for operating expenses to fulfill the third year of the Department's five-year contractual agreement with the Supercomputer Computational Research Institute for a total authorization of $45,364,000, including $44,264,00 for operating expenses and $1,100,00 for capital equipment.

Engineering and geosciences

The Committee supports the Department's request of $31,162,000 for Engineering and Geosciences, including $29,412,00 for operating expenses and $1,750,000 for capital equipment.

Advanced energy projects

The Committee supports the Department's request of $9,262,000 for Advanced Energy Projects, including $8,932,000 for operating expenses and $330,000 for capital equipment.

Biological energy research

The Committee supports the Department's request of $15,148,000 for Biological Energy Research, including $14,538,000 for operating expenses and $610,000 for capital equipment.

Program direction

The Committee supports the Department's request of $4,125,000 for Program Direction.

b. Energy Research Analysis

The Committee supports the Department's request of $3,550,000 for Energy Research Analysis.

c. University Research Support

The Committee supports the Department's request of $10,975,000 for Univesity Research Support, including $7,775,000 for University Laboratory Cooperative Research; $1,900,000 for University Reactor Fuel Assistance; $500,000 for Energy Manpower Assessment; and $800,000 for Energy Education and Training.

d. University Research Instrumentation

The Committee supports the Department's request of $5,000,000 for University Research Instrumentation.

e. Advisory and Oversight Program Direction

The Committee supports the Department's request of $2,900,000 for Advisory and Oversight Program Direction.

f. Multiprogram Energy Laboratories—Facilities Support

The Committee supports the Department's request of $60,190,000 for Multiprogram Energy Laboratories—Facilities Support, including $14,255,000 for Environmental Compliance (Oak Ridge National

Laboratory) operating expenses; $1,000,000 for Environmental Compliance (Oak Ridge National Laboratory) capital equipment; $10,000,000 for Environmental Compliance (Oak Ridge National Laboratory) construction; and $34,395,000 for Multiprogram Energy Laboratories—General Purpose Facilities construction.

g. Policy and Management

The Committee supports the Department's request of $550,000 for Policy and Management.

General reduction

The Committee directs the Department to apply a general reduction of $34,423,000 across the Supporting Research and Technical Analysis programs to maintain a total fiscal year 1987 authorization of $506,591,000 for these programs. This general reduction may be applied at the Department's discretion to assure that the funds not explicitly identified by the Committee may be used for the remaining highest priority programs.

DETAILED SUMMARY

Details of the Committee's recommendations, current year estimates and the budget request for Supporting Research and Technical Analysis are shown on the following tables:

SUPPORTING RESEARCH AND TECHNICAL ANALYSIS—FISCAL YEAR 1987 BUDGET AUTHORIZATION

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
Basic energy sciences:				
Materials sciences:				
Operating expenses	134,248	156,931	0	156,931
Capital equipment	11,979	15,500	0	15,500
Construction:				
84–ER–111, beam lines and support area construction, NSLS, BNL	6,928	2,600	0	2,600
84–ER–112, Center for Advanced Materials, LBL	11,008	10,560	0	10,560
84–ER–113, SSRL enhancement, SLAC	2,463	1,717	0	1,717
84–ER–115, National Center for Chemical Research, Columbia University	7,698	0	0	0
85–ER–133, Advanced Science Center, University of Oregon	8,179	0	0	0
86–R–401, accelerator and reactor improvements and modifications, various locations	1,727	0	0	0
86–R–300, Center for Science and Technology, Atlanta University	4,300	0	0	0
87–R–401, accelerator and reactor improvements and modifications, various locations	0	2,583	0	2,583
87–R–403, neutron scattering experimental hall, LANL	0	5,000	0	5,000
87–R–406, 1–2 GeV synchrotron radiation source, LBL	0	1,500	0	1,500
Subtotal, construction	42,333	23,960	0	23,960
Subtotal, materials sciences	188,560	196,391	0	196,391

SUPPORTING RESEARCH AND TECHNICAL ANALYSIS—FISCAL YEAR 1987 BUDGET AUTHORIZATION—Continued

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
Chemical sciences:				
Operating expenses	78,123	86,419	+5,000	91,419
Capital equipment	8,506	9,555	0	9,555
Construction:				
85–ER–403, Ion Collision Physics Facility, Kansas State University	1,828	1,200	0	1,200
86–R–400, general plant projects, various locations	3,781	0	0	0
87–R–400, general plant projects, various locations	0	3,930	0	3,930
87–R–401, accelerator and reactor improvements and modifications, ORNAL	0	300	0	300
Subtotal, construction	5,609	5,430	0	5,430
Subtotal, chemical sciences	92,238	101,404	+5,000	106,404
Nuclear sciences:				
Operating expenses	41,445	46,913	0	46,913
Capital equipment	2,457	2,930	0	2,930
Construction:				
86–R–400, general plant projects, various locations	96	0	0	0
86–R–401, accelerator and reactor improvements and modifications, various locations	1,155	0	0	0
87–R–400, general plant projects, SSRL	0	150	0	150
Subtotal, construction	1,251	150	0	150
Subtotal, nuclear sciences	45,153	49,993	0	49,993
Applied mathematical sciences:				
Operating expenses	37,925	32,785	+11,479	44,264
Capital equipment	1,030	1,100	0	1,100
Construction: Demonstration Center for Information Technologies, Brown University	4,811	0	0	0
Subtotal, applied mathematical sciences	43,766	33,885	+11,479	45,364
Engineering and geosciences:				
Operating expenses	25,571	29,412	0	29,412
Capital equipment	1,443	1,750	0	1,750
Construction: Energy and Mineral Research Center, University of Alabama	7,698	0	0	0
Subtotal, engineering and geosciences	34,712	31,162	0	31,162
Advanced energy projects:				
Operating expenses	7,286	8,932	0	8,932
Capital equipment	308	330	0	330
Subtotal, advanced energy projects	7,594	9,262	0	9,262
Biological energy research:				
Operating expenses	11,960	14,538	0	14,538
Capital equipment	515	610	0	610
Construction: 86–R–302, Center for Energy and Biomedical Technology, Tulane University	5,773	0	0	0
Subtotal, biological energy research	18,248	15,148	0	15,148
Program direction: Operating expenses	3,499	4,125	0	4,125

SUPPORTING RESEARCH AND TECHNICAL ANALYSIS—FISCAL YEAR 1987 BUDGET AUTHORIZATION—Continued

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
Subtotal, basic energy sciences	433,770	441,370	+16,479	457,849
(Operating expenses)	(340,057)	(380,055)	(+16,479)	(396,534)
(Plant and capital equipment)	(93,713)	(61,315)	(0)	(61,315)
Energy research analysis: Operating expenses	2,598	3,550	0	3,550
University research support:				
Operating expenses:				
University reactor fuel assistance	3,753	1,900	0	1,900
University laboratory cooperative research	5,773	7,775	0	7,775
Energy manpower assessment	385	500	0	500
Energy education and training	385	800	0	800
Subtotal, university research support	10,296	10,975	0	10,975
University research instrumentation: Operating expenses	6,254	5,000	0	5,000
Advisory and oversight program direction: Operating expenses	2,674	2,900	0	2,900
Multiprogram energy laboratories—facilities support:				
Environmental Compliance (Oak Ridge National Laboratory):				
Operating expenses	9,307	14,255	0	14,255
Capital equipment	962	1,000	0	1,000
Construction:				
86–R–800, general plant projects	3,849	0	0	0
86–R–801, nonradiological process waste treatment project	2,887	7,000	0	7,000
87–R–770, general plant projects	0	3,000	0	3,000
Subtotal, construction	6,736	10,000	0	10,000
Subtotal, environmental compliance (ORNL)	17,005	25,255	0	25,255
Multiprogram energy laboratories—General purpose facilities (MEL–GPF):				
Construction:				
80–ES–11, Idaho laboratory facility, INEL	722	0	0	0
84–ER–103, road repair Richland, LBL, INEL, ANL	2,973	2,008	0	2,008
85–R–701, central chilled water facility, BNL	6,832	5,700	0	5,700
85–R–702, replace lab roofs, ANL	2,983	2,392	0	2,392
85–R–703, primary electrical distribution system restoration, ORNL	0	1,400	0	1,400
85–R–706, medical facility, LANL	2,694	4,000	0	4,000
85–R–707, Hanford site fire alarm system upgrade, Richland	1,708	1,225	0	1,225
85–R–709, central chilled water plant, ANL	962	3,600	0	3,600
85–R–711, upgrade environmental monitoring system, ORNL	2,406	0	0	0
85–R–712, central chilled water system restoration, ORNL	1,058	2,600	0	2,600
86–R–726, fire protection improvements (phase II) BNL	481	2,500	0	2,500
87–R–751, laboratory restoration I, Richland	0	2,100	0	2,100
87–R–752, piping system restoration, ORNL	0	725	0	725
87–R–753, rehabilitate laboratory space, ANL	0	1,235	0	1,235
87–R–755, mechanical systems rehabilitation, ANL	0	1,100	0	1,100
87–R–756, water line replacement, ANL	0	1,000	0	1,000
87–R–757, electrical system rehabilitation, LBL	0	300	0	300

SUPPORTING RESEARCH AND TECHNICAL ANALYSIS—FISCAL YEAR 1987 BUDGET AUTHORIZATION—Continued

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
87-R-758, rehabilitate mechanical utilities, LBL	0	1,050	0	1,050
87-R-759, upgraded steam distribution system, ORNL	0	2,000	0	2,000
Subtotal, MEL-GPF	22,819	34,935	0	34,935
Subtotal, construction	29,555	44,935	0	44,935
Subtotal, multiprogram energy laboratories—Facilities support	39,824	60,190	0	60,190
Policy and management: Operating expenses	84	550	0	550
Subtotal, supporting research and technical analysis	495,500	524,535	+16,479	541,014
(Operating expenses)	(371,270)	(417,285)	(+16,479)	(433,764)
(Plant and capital equipment)	(124,230)	(107,250)	(0)	(107,250)
General reduction	0	0	−34,423	−34,423
Total, supporting research and technical analysis	495,500	524,553	−17,944	506.591

6. Environmental Research and Development

The Department of Energy's (DOE) environmental program was established to assure that the environmental research, assessment and control issues related to current and developing energy technologies are addressed effectively. The program is divided into three major categories: Environment, Safety and Health; Biological and Environmental Research; and the Liquefied Gaseous Fuels Spill Test Facility.

COMMITTEE ACTION

The Committee directs that within the operating expenses authorized for Environmental Research and Development, $3 million should be made available for the establishment of a new and expanded facility for nuclear medicine research in monoclonal-antibody-based imaging and treatment methods at the Center for Molecular Medicine and Immunology at the University of Medicine and Dentistry of New Jersey in Newark, New Jersey.

COMMITTEE VIEW

The Committee is concerned with a lack of public credibility in DOE's assurance of safe and environmentally sound operations. DOE is in the process of developing public/worker outreach programs at its facilities in order to address these concerns. The Committee directs DOE to report to the Committee on progress in developing public/worker outreach programs. These programs should entail a joint effort by the Environment, Safety and Health program and the Biological and Environmental Research program.

(a) Environment, Safety and Health

The Environment, Safety and Health (ES&H) program was established to assure protection of the environment, safety and health of DOE workers and the public, and to assure protection of DOE property. The ES&H program implements these goals by defining DOE policy, providing guidance and technical assistance, performing safety related research of a generic nature and performing independent overview and assessment.

On September 18 1985 Secretary Herrington announced a series of initiatives to strengthen the ES&H function within the Department. These initiatives include: consolidation of oversight responsibility for environment, safety, health, and quality assurance under the direction of an Assistant Secretary for Environment, Safety, and Health; conducting a baseline environmental survey of all DOE facilities to identify existing areas of environmental risk and to set priorities for corrective action; and performance of technical safety appraisals of DOE's high- and moderate-hazard nuclear facilities.

The FY 1987 budget for specific ES&H program elements described below reflects these changing priorities within the Department.

1. *Nuclear safety.*—The nuclear safety program assures safe operation of the Department's nuclear facilities and protection of workers, the public, and property. During FY 1987 increased funding for this program element will support safety reviews and technical appraisals at a number of high-hazard nuclear facilities.

2. *Quality assurance and standards.*—The objective of the quality assurance program is to provide a system of management controls and procedures to assure that research and production activities conform to requirements established by the Department. Assurance is provided principally through internal policy coordination and performance of overview and management appraisals.

3. *Operational safety.*—The operational safety program has responsibility for providing oversight of all DOE government-owned, contractor-operated facilities to assure that: DOE contractor employees at these facilities are protected against occupational hazards; the public and property is protected against operational hazards; and the Department is in compliance with environmental protection, safety, and health protection policies, laws and principles. The program develops safety and health requirements and policies, conducts evaluations and appraisals, and provides technical advice and support.

4. *Environmental audit and compliance.*—The environmental audit and compliance program was established in FY 1986 as a result of the new ES&H initiatives. This program element ensures that the Department's operating facilities are in compliance with all applicable environmental requirements and is responsible for reducing areas of environmental risk. The environmental audit and compliance program evaluates and recommends selection of corrective measures, establishes budget priorities, monitors compliance progress, provides technical support, and serves as a liaision with federal and state agencies in the resolution of compliance issues.

The FY 1987 budget for the environmental audit and compliance program includes increased funding for a survey of DOE facilities in order to identify existing areas of environmental risk and to set priorities for necessary corrective action. According to the General Accounting Office (GAO/RCED-86-68FS), DOE intends to issue interim reports as work is completed at each site. These interim reports will identify environmental, safety or health problems that require immediate as well as long-term attention.

COMMITTEE VIEW

The Committee directs DOE to issue interim environment, safety, and health reports from the environment and safety appraisals to the Committee. These reports should identify problems that require immediate attention as well as problems that can be addressed in the long-term.

5. *Environmental guidance.*—As a result of the FY 1986 ES&H initiatives, the environmental guidance program now includes functions previously performed by the former environmental compliance and environmental protection elements. The environmental guidance office has responsibility for development of compliance policies and guidance documents, standards, and internal DOE orders. This office also notifies DOE personnel of emerging and changing environmental regulations which may impact the Department's activities. The FY 1987 budget includes an increase over FY 1987 in order to support ES&H responsibilities.

6. *Environmental analysis.*—The environmental analysis program provides a Departmental focal point for analysis of current and emerging environmental issues, laws, regulations, and technologies that impact U.S. energy supply and Departmental policies, plans, programs, and facilities. This program analyzes and coordinates the Department response to these regulatory proposals that may impact energy activities, and includes participation in acid rain analyses.

7. *Program direction.*—This program contains the personnel cost for 127 staff years for FY 1987, which includes an increase of 2 FTEs over FY 1986. This personnel is required to accomplish the federal staff responsibilities in assuring protection of the environment, safety of workers and the public, and protection of the Department's property.

8. *Capital equipment.*—The capital equipment program supports ES&H's operating activities conducted at seven national laboratories and several other dedicated Department-wide contractors. A variety of capital equipment is required to pursue the diverse program of research and assessment of environment, safety and health impacts of energy production. Additional funding in FY 1987 is required to expand computer capability, provide replacement equipment for response to incidents involving radioactive materials, and provide equipment for the rediation measurement accreditation program.

(b) Biological and Environmental Research

The Biological and Environmental Research (BER) program conducts long-term, multidisciplinary, and broadly-based research pro-

grams designed to identify, before a technology is locked into place, the early and late effects of human health and the environment. This program provides, through basic and applied research, scientific data required to reduce the health and environmental uncertainties associated with energy technology and weapons development. Some of the issues addressed under this program are the potential environmental effects of acid rain and the increase in atmospheric carbon dioxide (the "greenhouse effect") and the health consequences of exposure to nuclear radiation and chemical mixtures. The BER program has an additional responsibility to develop new applications of nuclear science and technology for use the diagnosis and treatment of human diseases.

The BER program is the only long-term, nationwide research effort specifically focused on energy-related health and environmental issues. The program is divided into serveral subprograms, described below:

1. *Source and dose determination.*—The objective of the source and dose determination research program is to assess the human or ecosystem exposure that may result from the operation of current or future energy technologies. Recently this program, in conjunction with the Department's conservation program, has addressed health issues associated with exposure to radon and radon daughters in the indoor air environment, and this effort will be expanded in FY 1987. In addition, research is conducted to improve techniques for the direct measurement of human exposure to ionizing radiation or to energy-related chemicals.

2. *Environmental processes and effects.*—This program is designed to anticipate environmental impacts of energy activities, to understand processes of existing or past environmental stresses in order to determine their effects, and to propose ways to prevent or overcome deleterious impacts on the environment. Atmospheric, terrestrial, and aquatic research are included in this program in order to determine the pathways and mechanisms whereby energy-related agents move through the environment and their subsequent impact on the ecosystem. This information is critical for understanding of important environmental issues such as acid rain. In FY 1987, there will be an increased effort on atmospheric and environmental research.

3. *Health effects.*—The objective of this research program is to increase understanding of human health risks that may result from exposures to ionizing radiation or to energy-related chemicals. Since the most common human exposures are of the chronic, low-dose type, this program emphasizes research on cancer, heritable defects that are transmissible to offspring, and other delayed or late-occurring health effects that may be associated with such exposures. An expanded radon research effort is included in the FY 1987 health effects budget.

COMMITTEE ACTION

The Committee directs the Secretary of Energy and the Administrator of the Environmental Protection Agency to expeditiously pursue current studies on radon emissions associated with the

Reading Prong. These studies include but are not limited to the following:

Development and Validation of Standardized Methods for Radon Mitigation, Testing and Diagnosis;

The Development and Demonstration of Radon Reduction Techniques for Existing Homes; and

Lung Cancer Risks from Radon Daughters in Domestic Environments.

This information shall be made available to the Committee and the public immediately after the data has been collected and analyzed. The Committee also encourages the DOE to compile the Maine, New Jersey, and Pennsylvania radon studies currently being conducted by DOE and EPA and analyze this collection data wherever feasible. This analysis would be in addition to the reports prepared from the data on the individual studies.

COMMITTEE VIEW

In order to ensure that the limited resources available for radon research are utilized effectively, the Committee directs DOE to enter into a Memorandum of Understanding with the Environmental Protection Agency (EPA) to establish a radon research plan which defines each agency's role in radon research. The plan should encompass: all of the radon assessment and mitigation research and development effort in the DOE Environmental and Conservation Program; the Bonneville Power Administration efforts in applied radon research and field assessments; and the related EPA radon assessment and mitigation research and development efforts. In particular, DOE should work with EPA on the transfer of developed technologies to the states and to the private sector.

4. *General life sciences.*—The objectives of the basic biology research program are to provide fundamental information on biological structure and function and to develop an understanding of the biological mechanisms which underlie human health effects on radiation and energy-related chemicals. In FY 1987 a segment of this reseach program will focus on identification of factors involved in transformation of normal cells to a malignant state.

5. *Nuclear medicine.*—The nuclear medicine research program conducts research and development on the use of radiation and radionuclides for medical diagnosis and treatment of human disease. The Department of Energy's facilities for conducting research in this area are unique within the Federal government. The DOE nuclear medicine program has led to widespread use of radioisotopes for improved diagnosis and treatment of human diseases. Recent breakthroughs, such as the method of attaching radionuclides to monoclonal antibodies, will have a significant impact on the diagnosis, treatment and prevention of human disease and DOE will expand this research effort in FY 1987.

COMMITTEE ACTION

The Administration's FY 1987 budget request included a reduction from the FY 1986 level of $23.3 million to $22.1 million, or a cut of $1.2 million from the nuclear medicine program. Based on the remarkable successes of this program, the Committee directs

DOE to redirect $1.2 million from the general health and environmental research program to nuclear medicine, and directs that these additional funds be committed for continuation of research and treatment of health and brain disorders through heavy ion therapy and the research and development of increased imaging resolution for positron emission tomography.

6. Carbon dioxide research.—This program is designed to improve the understanding of fundamental scientific relationships between carbon dioxide concentration and climate to aid in energy policy decisions. Improved measurements and the development of reliable models will answer questions about the relationships between future atmospheric levels of carbon dioxide and other trace gases, the magnitude of climate change and the responses of crops and ecosystems. During FY 1986, State-of-the-Art reports were published on four major components of the carbon dioxide research program. These reports identified key uncertainties and recommended research activities and several of high priority recommendations which will be implemented in FY 1987 including: analysis of regional applications of global climate models, the influence of clouds on climate change, ocean/atmospheric interactions, determination and mapping of populations and vegetation sensitive to climate change, and increased international outreach.

7. *Program direction.*—This program includes salaries, benefits, travel and related personnel costs for 53 full-time equivalent employees. This staff provides guidance and support for about 760 research projects, develops long-range plans, and conducts reviews of BER sponsored programs at laboratories and universities.

8. *Capital equipment.*—The capital equipment fund provides for support of the BER program and the Pacific Northwest Laboratory landlord responsibilities. The equipment is utilized in areas of research on health and environmental issues associated with energy technologies and on research and development of nuclear medicine technology.

9. *Construction.*—Construction funds for the BER program are necessary to maintain satisfactory and economical operating conditions, to meet regulatory requirements and to provide for new program developments under the Pacific Northwest Laboratory landlord responsibility (project number 87-R-120).

COMMITTEE VIEW

International geosphere/biosphere program

The Committee continues to endorse the concept of an International Geosphere/Biosphere Program and accordingly notes with approval the National Research Council (NRC) report, "Global Change in the Geosphere Biosphere". [1] The Committee notes with particular approval the following points made in that report:

> Governments throughout the world feel a need to come to grips with a series of growing concerns that deal with the global environment. The layman perceives a degradation of the quality of life on—if not yet the habitability of—the planet. The scientist sees complex problems that

[1] National Academy Press, Washington, DC, 1986.

> reach beyond conventional fields of disciplinary study. We [the NRC] think the need for action is so great as to warrant the mounting of a bold new program, and the issues so urgent and compelling that it must be started now. . . Today we hold the means, in recent advances in science and technology, to mount such a program and . . . to expect a measure of success.
>
> The bulk of the changes that affect the course of life and the environment of Earth are natural ones . . . [but] imposed on these is now another set of changes, more recent and immediate in consequence, that are the clear result of the hand of man . . . Policymakers are faced with a baffling array of problems—apparent damage to large forest regions in Europe, deterioration of lakes in Scandanavia and eastern North America, climatic impacts of deforestation in the tropics, fluctuations in the extent of deserts in Asia, Africa and North America, depletion and pollution of groundwaters, and growing levels of tropospheric oxidants, to mention but a few. There are increasing demands for action and for reliable information.

In view of these problems and these demands, the NRC has suggested an "integrated, global study of the physical, chemical and biological processes that have produced and now maintain the environment needed for life on Earth."

The NRC urges the following as a focused objective for such a study:

> To describe and understand the interactive physical, chemical, and biological processes that regulate the Earth's unique environment for life, the changes that are occurring in this system, and the manner in which they are influenced by human actions.

In an IGBP, biospheric interactions would be the "focus and discriminator in setting priorities and principal emphases . . . Priority in an IGBP of this design would fall on those areas of each of the fields involved that show the greatest promise of eludicating interactions that might lead to significant change in the next 100 years, that most affect the biosphere, and that are most susceptible to human perturbation."

Clearly the challenge of such a program is great; indeed, it is comparable to the potential benefits. The Committee believes that such a program must be conducted and urges the research agencies under its jurisdiction to foster an IGBP.

In its efforts to locate and develop the Nation's energy resources, in its associated efforts to find a safe storage site for nuclear waste, and in its attempts to understand the effects of energy production and use on the environment, the Department of Energy has established a number of research programs that study the continental landmass, the offshore environment and the atmosphere. The results of this research will be as valuable to the IGBP as they are to the accomplishment of the Department's mission. Ongoing efforts to monitor the level of carbon dioxide in the atmosphere are vital to characterizing the geochemical and biochemical activity of

carbon and will be necessary to understand and predict the response of the oceans to stresses induced the global warming expected as a result of the "greenhouse effect". Recent research aimed at establishing the feasibility of a nuclear waste repository under the seafloor has led the Department to studies of nitrogen and phosphorus cycles in the marine environment and to efforts aimed at understanding the geological history of the ocean. Activities like these, coordinated by the National Academy of Sciences Committee for an International Geosphere Biosphere Program, will allow the Department to make positive contribution to this effort.

(c) Liquefied Gaseous Fuels Spill Test Facility

The Liquefied Gaseous Fuels Spill Test Facility is a unique facility designed for conducting spill tests of liquefied gaseous fuels and other hazardous chemicals. This program was established to develop information needed by industry, regulatory agencies, and the general public on the potential hazards of these materials during handling, shipping, and storage. The dispersion and combustion of gaseous materials accidentally released into the environment will be studied and a technical data base on safety- and environmentally-related control information will be developed at this facility. The facility will be supported by industry and government agencies on a user-fee basis.

COMMITTEE VIEW

In order to ensure that information developed at this facility is available to the public in a timely and understandable manner, the Committee directs DOE to develop a Memorandum of Understanding with the Environmental Protection Agency and the Department of Transportation establishing a long-term research and management plan (funded by DOE at approximately $1 million each year after FY 1987) which designates DOE as the facility sponsor for collaborative research and facility operations at the Liquefied Gaseous Fuels Spill Test Facility in Nevada.

DETAILED SUMMARY

Details of the Committee's recommendations, current year estimates and the budget request for Environmental R&D are contained in the following table:

ENVIRONMENTAL R&D—FISCAL YEAR 1987 BUDGET AUTHORIZATION

[In thousands of dollars]

	Fiscal year—		Committee action	
	1986 estimated	1987 DOE request	Change to DOE request	Recommendation
Environmental, Safety, and Health:				
Operating expenses:				
Nuclear safety	16,916	17,225	0	17,225
Quality assurance and standards	914	800	0	800
Operational safety	4,373	3,900	0	3,900
Environmental audit and compliance	7,500	34,00	0	34,000
Environmental guidance	3,623	3,900	0	3,900
Environmental analysis	2,457	2,700	0	27,000

ENVIRONMENTAL R&D—FISCAL YEAR 1987 BUDGET AUTHORIZATION—Continued

[In thousands of dollars]

	Fiscal year—		Committee action	
	1986 estimated	1987 DOE request	Change to DOE request	Recommendation
Program direction	9,695	11,473	0	11,473
Subtotal, operating expenses	45,478	73,998	0	73,998
Capital equipment	1,443	2,100	0	2,100
Subtotal, Environment, Safety and Health Program	46,921	76,098	0	76,098
Biological and Environmental Research:				
Operating expenses:				
Health and environment:				
Source and dose determination	14,810	16,571	0	16,571
Environmental processes and effects	29,867	32,877	0	32,877
Health effects	57,710	65,947	0	65,947
General life science	27,953	29,870	0	29,870
General reduction	0	0	−1,200	−1,200
Subtotal, health and environment	130,340	145,265	−1,200	144,065
Nuclear medicine	23,311	22,120	+1,200	23,320
Carbon dioxide	12,586	13,580	0	13,580
Program direction	3,129	3,600	0	3,600
Subtotal, operating expenses	169,366	184,565	0	184,565
Capital equipment	7,457	8,500	0	8,500
Construction	3,127	3,500	0	3,500
Total, biological and environmental research	179,950	196,565	0	196,565
Liquefied Gaseous Fuels Spill Test Facility: Total, operating expenses	1,732	1,200	0	1,200
Total, environmental R&D	228,603	273,863	0	273,863
(Operating expenses)	(216,576)	(259,763)	0	(259,763)
(Plant and capital equipment)	(12,027)	(14,100)	0	(14,100)

D. GEOTHERMAL RESOURCES DEVELOPMENT FUND

The Geothermal Loan Gu ntee Program is authorized under Title II of the Geothermal ergy Research, Development and Demonstration Act of 1974 (I 93–410), as amended by Title V of the Department of Energy Act f 1978—Civilian Applications (P.L. 95–238) and Title VI of the Energy Security Act of 1980 (P.L. 96–294). The Department's fiscal year 1987 request of managing the fund is $72,000.

COMMITTEE ACTION

The Committee supports the Department's request of $72,000 for the Geothermal Resources D pment Fund.

GEOTHERMAL RESOURCES DEVELOPMENT —FISCAL YEAR 1987 BUDGET AUTHORIZATION

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
Operation expenses	69	72	0	72
Total, Geothermal Resources Development Fund	69	72	0	72

E. GENERAL SCIENCE AND RESEARCH

The Department's General Science and Research programs are organized into two interrelated programs: High Energy Physics and Nuclear Physics. The salaries, benefits and associated costs of the staff of these two programs are also included in this budget category as a separate program, called General Science Program Direction. The fiscal year 1987 request for General Science and Research is $773,400,000 an increase of $118,978,000 from the fiscal year 1986 appropriation of $655,422,000.

COMMITTEE VIEWS

High energy physics

The Committee is pleased with the excellent progress made by the Central Design Group in defining the scope and cost of the Superconducting Super Collider (SSC). It is the Committee's understanding that the Secretary of Energy will decide during fiscal year 1986 whether or not to proceed with the construction of the SSC in fiscal year 1988 or fiscal year 1989. In the event that either the decision is made not to proceed with the construction of the SSC, or that there is no decision made during fiscal year 1986, the Department is directed to cease all funding for the project in fiscal year 1987.

Nuclear physics

The Committee strongly supports the Department's request to begin construction on the Continuous Electron Beam Accelerator Facility (CEBAF) in fiscal year 1987. CEBAF has been thoroughly reviewed by the Nuclear Science Advisory Committee and is its highest priority. The construction start in fiscal year 1987 is essential for a timely construction project schedule. The intensity, energy rang, and continuous nature of CEBAF's beams will make this facility unmatched in the world.

COMMITTEE ACTIONS

High energy physics

The Committee supports the Department's request of $546,700,000, including $427,500,000 in operating expenses, $77,500,000 in capital equipment, and $41,700,000 in construction.

Nuclear physics

The Committee's recommendations for Nuclear physics decreases the Department's request by $5,000,000 for Project 87-R-203, the Continuous Electron Beam Accelerator Facility (CEBAF), for a total project authorization of $20,000,000, and a total program authorization of 219,200,000, including $174,900,000 in operating expenses, $16,000,000 in capital equipment, and $28,300,000 in construction.

General reduction

The Committee directs the Department to apply a general reduction of $92,173,000 across the General Science and Research programs to maintain a total fiscal year 1987 authorization of $676,227,000 for these programs, a decrease of $97,173,000 from the Department's fiscal year 1987 request of $773,400,000. This general reduction may be applied at the Department's discretion to assure that the funds not explicitly identified by the Committee may be used for the remaining highest priority programs.

DETAILED SUMMARY

Details of the Committee's recommendations, current year estimates and the budget request for General Science and Research are shown on the following tables:

GENERAL SCIENCE AND RESEARCH—FISCAL YEAR 1987 BUDGET AUTHORIZATION

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
High energy physics:				
Physics research: Operating expenses	106,268	118,600	0	118,600
Facility operations:				
Operating expenses	175,095	213,400	0	213,400
Capital equipment	69,984	77,500	0	77,500
Construction:				
81–E–218 Tevatron 1, Fermilab	8,233	367	0	367
84–ER–133 SALC linear collider (SLC)	21,294	976	0	976
86–R–101 accelerator improvements and modifications, various locations	10,052	0	0	0
86–R–102 general plant projects, various locations	9,957	0	0	0
86–R–104 central computer upgrade, fermilab	2,968	14,157	0	14,157
86–R–105 AGS accumulator/booster, BNL	1,915	3,500	0	3,500
87–R–101 accelerator improvements and modifications, various locations	0	11,500	0	11,500
87–R–102 general plant projects, various locations	0	11,200	0	11,200
Subtotal, Construction	55,049	41,700	0	41,700
Subtotal, facility operations	300,128	332,600	0	332,600
High energy technology: Operating expenses	88,462	95,500	0	95,500
Subtotal, high energy physics	494,858	546,700	0	1546,700
(Operating expenses)	(369,825)	(427,500)	(0)	(427,500)
(Plant and capital equipment)	(125,033)	(119,200)	(0)	(119,200)
Nuclear physics:				
Medium energy nuclear physics: Operating expenses	73,131	85,000	0	85,000
Heavy ion nuclear physics: Operating expenses	50,150	63,700	0	63,700
Low energy nuclear physics: Operating expenses	12,087	15,700	0	15,700
Nuclear theory: Operating expenses	8,999	10,500	0	10,500
Subtotal, operating expenses	144,367	174,900	0	174,900
Capital equipment	13,403	16,000	0	16,000

GENERAL SCIENCE AND RESEARCH—FISCAL YEAR 1987 BUDGET AUTHORIZATION—Continued

[In thousands of dollars]

	Fiscal year—		Committee action	
	Estimated 1986	1987 DOE request	Change to DOE request	Recommendation
Construction:				
86-R-201 accelerator improvements and modifications, various locations	3,351	0	0	0
86-R-202 general plant projects, various locations	3,351	0	0	0
87-R-201 accelerator improvements and modifications, various locations	0	4,300	0	4,300
87-R-202 general plant projects, various locations	0	4,000	0	4,000
87-R-203 Continuous Electron Beam Accelerator Facility (CEBAF), Newport News, VA	0	25,000	−5,000	20,000
Subtotal, construction	6,702	33,300	−5,000	28,300
Subtotal nuclear physics	164,472	224,200	−5,000	219,200
(Operating expenses)	(144,367)	(174,900)	(0)	(174,900)
(Plant and capital equipment)	(20,105)	(49,300)	(−5,000)	(44,300)
General science program direction: Operating expenses	2,092	2,500	0	2,500
Subtotal, general science and research	661,442	773,400	−5,000	768,400
(Operating expenses)	(526,284)	(604,900)	(0)	(604,900)
(Plant and capital equipment)	(145,138)	(168,500)	−5,000	(163,500)
(Transfer of appropriation)	−6,000	0	0	0
General reduction	0	0	−92,173	−92,173
Total, general science and research	655,422	773,400	−97,173	676,227

F. URANIUM ENRICHMENT R&D

The Uranium Enrichment R&D programs under the Committee's sole jurisdiction are the Gas Centrifuge Process Development and Demonstration, and the Atomic Vapor Laser Isotope Separation (AVLIS) Technology Development programs. The Department's fiscal year 1987 request for these programs totals $54,00,000 for operating expenses, a decrease of $90,290,000 from the fiscal year 1986 appropriation of $114,290,000.

The Gas Centrifuge Process Development and Demonstration program is in the process of being terminated. The $4,000,000 in requested funding is for completing the documentation on development, for decommissioning contractor-owned facilities, and for selling or transferring the program equipment.

The AVLIS Technology Development program is directed toward bringing to demonstration a significantly less expensive method for enriching uranium. This new technology is expected to replace the much more expensive gaseous diffusion process which is presently the only method of enriching uranium in the United States. The fiscal year 1987 DOE requested budget is $76,975,000 lower than the appropriation for FY 1986. DOE justifies this deep reduction on the basis that it will obtain the additional necessary funds to complete development and deployment of AVLIS from the private sector. Yet DOE claims that the AVLIS program is essential to

"assure the United States enrichment enterprise long-term price competitiveness by producing enriched uranium at a cost significantly less than the marginal production costs for GDP's [gaseous diffusion plants]."

COMMITTEE VIEWS

Gas Centrifuge Process Development and Demonstration

The Committee is concerned that, with the exception of defense applications, the DOE has made little real effort to achieve a transfer of the centrifuge technology to the private sector. Despite language in the Committee's fiscal year 1986 report, and similar report language from the Appropriations Committees in both Houses of Congress, DOE has not done an adequate job of technology transfer. Recently, however, the Committee notes some evidence of progress in centrifuge technology transfer, and would encourage the Department of Energy to continue this effort.

In fact, just as a private corporation has social responsibilities in the community in which it conducts business, the DOE has responsibilities of technology transfer in the enrichment business. Since DOE makes the programmatic decisions as to how enrichment revenues are spent, it cannot abdicate the responsibility to see that technology development dollars have greatest impact in the public and private sectors. The Committee believes that modest funding of technology transfer is an appropriate business expense to be recovered through DOE's enrichment prices. The private sector should be made familiar with the centrifuge capabilities and provided limited funding to overcome the institutional and technological barriers of potential civilian applications. Otherwise, the $3,000,000,000 Federal investment in centrifuge technology will largely have been wasted. As an example of private sector interest, the Committee is familiar with the Electro-Nucleonics proposal relative to medical applications of advanced centrifuge technology.

The Committee also notes its deep concern over the DOE's precipitous destruction of centrifuge machines and fabrication equipment in spite of apparent knowledge of potential residual value in these components and without keeping the Committee fully and currently informed. The Committee has initiated an investigation of the propriety of DOE's actions and will pursue the issue until all relevant facts are known to the Committee.

AVLIS Technology Development Program

The Committee strongly supports development and deployment of the AVLIS program on as early a schedule as is practical. The Committee is convinced that the AVLIS process holds the potential to generate large Federal revenues for repayment of the enrichment debt to the Treasury. For this reason, the Committee's recommendations redirect $50,000,000 in funds to bring the AVLIS program to the $100,000,000 level that the Committee considers to be prudent.

Funding for the development of the AVLIS technology at the reduced $50,000,000 level proposed by the Department will not merely slow the pace of development of the AVLIS technology, but

will also cause a significant loss of important program personnel and undercut the Government's effort to make the U.S. uranium enrichment enterprise economically competitive with foreign suppliers.

The Committee understands that the remaining investment to demonstrate the AVLIS technology was previously estimated to be $420,000,000 over roughly three years. The DOE's fiscal year 1987 plan will substantially increase the costs to $700,000,000, and will stretch the deployment schedule to 1995 or beyond. Optimistically, DOE's new plan could provide a profit from an AVLIS production facility after approximately 14 years; presuming that a private investor can be readily found.

Aside from the issue of privatization, the Committee rejects DOE's deferred development and deployment proposal as inconsistent with the interests of the Government, DOE's customers, and utility ratepayers, who are served by DOE's customers. It was apparent to the Committee that DOE's hastily drawn fiscal year 1987 program strategy was the result of Office of Management and Budget dictates.

AVLIS privatization

The DOE's own Process Evaluation Board confirmed, just last year, that substantial work remains to be completed before the AVLIS process will demonstrate its capability for low-cost production of separative work units of enriched uranium. Considering the state of technology development, it is clear to the Committee that this level of investment and recovery period constitute a great deal of risk for a private sector investor. Despite the large profit margin that would have to be offered to entice an investor to take this kind of risk, the Committee observes that the estimated 14–17 year recovery period is significantly greater than the usual three-year corporate recovery period. These basic market considerations make the Committee highly skeptical of the potential for success at privatizing the AVLIS technology at this early date.

Additionally, there is sure to be controversy attendant with technology guarantees and other Government guarantees in any legislation authorizing the transfer of the technology to the private sector. The Committee recalls the controversy generated over the guarantees sought by the Department for the Clinch River Breeder Reactor project. Congressional concerns can also be expected on the merits of transferring a potentially highly profitable enrichment technology to the private sector at a time when the Government has written-off many enrichment expenditures; on how and when the private sector will be licensed to operate a laser enrichment facility; and on controlling the nuclear proliferation potential of private laser enrichment.

Because of all of these issues, the Committee concludes that, even if DOE could find a private investor, the Congress will probably be unable to consider and enact the necessary legislation to accomplish a transfer of the AVLIS technology by the end of fiscal year 1987, as the Department has optimistically planned in its proposed budget request.

The Committee notes its substantial reservations about privatizing the AVLIS technology for the aforementioned reasons. Despite

all of these concerns the Committee will reserve judgment on the merits of privatization of the AVLIS technology until specific proposals are made by the Department of Energy and carefully reviewed by the Congress.

COMMITTEE ACTIONS

Gas Centrifuge Process Development and Demonstration

The Committee's recommendations add $1,000,000 to the Department's request, for a total authorization of $5,000,000, for technology transfer. These funds shall be obtained by placing greater reliance on the enriched uranium inventory to supply customer needs.

AVLIS Technology Development Program

The Committee's recommendations add $50,000,000 into this program from within the Uranium Enrichment Activities budget request, for a total authorization of $100,000,000 to fully fund the development of this technology so as to enable the Government to deploy it as soon as is practicable. The funds shall be obtained by placing greater reliance on the enriched uranium inventory to supply customer needs.

The Committee believes that the Department has the potential to absorb the $51,000,000 of redirections into the two programs without changing the total budget authority requested by the Department. The Committee believes that a savings in production costs can be achieved by utilizing the preproduced inventory of enriched uranium.

DETAILED SUMMARY

Details of the Committee's recommendations, current year estimates and the budget request for Uranium Enrichment R&D are containted in the following table:

URANIUM ENRICHMENT R&D—FISCAL YEAR 1987 BUDGET AUTHORIZATION

[In thousands of dollars]

	Fiscal Year		Committee action	
	Estimated fiscal year 1986	Fiscal year 1987 DOE request	Change to DOE request	Recommendation
Gas centrifuge process development and demonstration:				
Operating expenses	17,315	4,000	+1,000	5,000
Capital equipment	0	0	0	0
Subtotal, gas centrifuge process development and demonstration	17,315	4,000	+1,000	5,000
AVLIS technology development:				
Operating expenses	109,660	50,000	+50,000	100,000
Capital equipment	14,429	0	0	0
Construction	2,886	0	0	0
Subtotal, AVLIS technology development	126,975	50,000	+50,000	100,000
Total, Uranium Enrichment R&D	144,290	54,000	+51,000	105,000
(Operating expenses)	126,975	54,000	+51,000	105,000
(Plant and capital equipment)	17,315	0	0	0

V. Effect of Legislation on Inflation

In accordance with Rule XI, Clause 2(l)(4), of the Rules of the House of Representatives, the following is a statement concerning the inflationary impact of H.R. 4925.

H.R. 4925 is assessed to have no significant inflationary effect on prices and costs in the operation of the national economy.

VI. Committee Oversight Findings and Recommendations

Pursuant to Rule XI, Clause 2(l)(3), of the Rules of the House of Representatives, and under the authority of Rule X, Clause 2(b)(1) and clause 3(f), the results and findings from the Committee's oversight activities are incorporated in the recommendations found in the present bill and report.

VII. Summary of Government Operations Committee Findings and Recommendations

No findings and recommendations on oversight activity pursuant to Rule X, Clause 4(C)(2), and Rule XI, Clause 2(l)(3), of the Rules of the House of Representatives, have been submitted by the Committee on Government Operations.

VIII. Budget Analysis and Projection—Congressional Budget Act Information

The bill H.R. 4925 provides no new budget authority or tax expenditures. Consequently, the provisions of Section 308(a) of the Congressional Budget Act are not applicable.

IX. Congressional Budget Office Cost Estimate

U.S. Congress,
Congressional Budget Office,
Washington, DC, July 23, 1986.

Hon. Don Fuqua,
Chairman, Committee on Science and Technology, U.S. House of Representatives, Rayburn House Office Building, Washington, DC.

Dear Mr. Chairman: The Congressional Budget Office has prepared the attached cost estimate for H.R. 4925, the Department of Energy Civilian Research and Development Act for Fiscal Year 1987.

If you wish further details on this estimate, we will be pleased to provide them.

With best wishes,

Sincerely,

RUDOLPH G. PENNER, *Director.*

CONGRESSIONAL BUDGET OFFICE—COST ESTIMATE

JULY 23, 1986.

1. Bill number: H.R. 4925.

2. Bill title: Department of Energy Civilian Research and Development Act for Fiscal Year 1987.

3. Bill status: As ordered reported by the House Committee on Science and Technology, July 17, 1986.

4. Bill purpose: The bill authorizes the appropriation of $2,939 million for 1987 for civilian research and development programs of the Department of Energy (DOE). The authorization includes funds for research in solar, fossil, nuclear, and other energy technologies. The bill also establishes a scientific research and development program aimed at increasing energy efficiency in the steel industry. This program is to be conducted as part of DOE's conservation activities.

5. Estimated cost to the Federal Government:

[By fiscal years, in millions of dollars]

	1987	1988	1989	1990	1991
Authorization level	2,939				
Estimated outlays	1,550	1,042	347		

The costs of this bill fall within budget functions 250 and 270.

Basis of Estimate: CBO assumes that all amounts authorized will be appropriated and that spending will occur at historical rates.

6. Estimated cost to State and local governments: None.

7. Estimate comparison: None.

8. Previous CBO estimate: On July 23, 1986, the Congressional Budget Office prepared a cost estimate for H.R. 4926, which also authorizes funding for DOE programs. The amounts in Title I of that bill are equal to the amounts authorized by H.R. 4925.

9. Estimate prepared by: Pete Fontaine and Paul DiNardo.

10. Estimate approved by: C.G. Nuckols (for James L. Blum, Assistant Director for Budget Analysis).

X. CHANGES IN EXISTING LAW MADE BY THE BILL AS REPORTED

In compliance with Rule XIII, Clause 3 of the Rules of the House of Representatives, there are no changes in existing law made by the bill, as reported.

XI. COMMITTEE RECOMMENDATIONS

A quorum being present, the bill H.R. 4925 was ordered reported on July 17, 1986, by the Committee by a voice vote.

XII. Dissenting Views

DISSENTING VIEWS FOR DOE AUTHORIZATION BILL, H.R. 4925

Most agree that the overriding domestic concern facing our country is deficit reduction and controlling Government spending. But no matter how many times we reiterate our commitment to this laudable objective, it is meaningless unless our deficit reduction rhetoric is translated into concrete action.

This Committee has fallen prey to a common affliction in Congress: a reluctance to make the difficult budget reduction choices. Despite claims of fiscal responsibility, the Department of Energy FY 1987 authorizations proposed in this bill which are solely within the jurisdiction of the Science and Technology Committee are $324 million above the administration's request. All four House Science and Technology Subcommittees which have jurisdiction over the DOE research and development programs reported authorizations which exceeded the President's request.

We realize that these R&D programs are important to our country's energy security and technological process. We further recognize that even with the more than $300 million additions contained in this authorization bill, the DOE programs remain below the 1986 apropriated levels. However, this bill sends the wrong signal by repudiating our commitment to control the enormous Federal debt by cutting spending. The annual deficit will never meet the Gramm-Rudman-Hollings targets unless we in Congress make the difficult choices to reduce Federal spending. If we are unable in this particular authorization bill to make a budget reduction of only a little over $300 million-less than 2/1000th of the annual deficit-how can we in good conscience say that we as an institution support reducing the deficit and balancing the Federal budget?

Tom Lewis.
Robt. S. Walker.
Bill Cobey.
Jim Sensenbrenner.
D. French Slaughter, Jr.
Paul B. Henry.
Manuel Lujan, Jr.
David S. Monson.
Robert C. Smith.
Joe Barton.
Ron Packard.

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